Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7708	0	0	0	0	Taylor and Alfaro 2005 : Taylor MA, Alfaro EJ (2005) Central America and the Caribbean, Climate of. In: Oliver JE (ed) Encyclopedia of world climatology. Encyclopedia of earth sciences series. Springer, Dordrecht. [isabelle gouirand, Barbados]	Noted. Not clear what revision is required.
7710	0	0	0	0	Figure 10.22: The quality (resolution) of the figure as presented in the report does not allow the reader to see features in the box associated to the six stations. (X and Y axis not readable)? [isabelle gouirand, Barbados]	Not applicable, figure has been changed
48032	0	0	0	0	Scoping Outline Check: Bullet point from the approved scoping are covered however there is no specific section devoted to discuss reanalysis uncertainty (e.g., https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-11-00251.1), and the importance it can have on the downscaled climate change projections (e.g., https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-14-00331.1). This topic is introduced in Atlas.3.2, but only superficially. Maybe there should be some kind of coordination between Chapter 10 and Atlas to address these two important topics? [WGI TSU, France]	Taken into account: The section "10.2.1.2 Derived products" now includes a discussion of uncertainty of reanalysis products and this has been coordinated with Atlas. The influence on downscaling is discussed in 10.2.3.
48052	0	0	0	0	Please check the correct use of IPCC Confidence/Uncertainty language. In some cases incorrect adjectives are being used with evidence or agreement terms, e.g., strong, growing, emerging, little, adequate, no robust, insufficient, weak, no contradictory, clear (some of them are redundant or not very precise). Please refer to the IPCC guidance note on uncertainty: https://wg1.ipcc.ch/SR/documents/ar5_uncertainty-guidance-note.pdf [WGI TSU, France]	Accepted. For the SOD the IPCC guidance note on uncertainty has been applied to all statements using confidence language.
28876	0	0	0	0	FAQs are good - the citites one is great and ambitouis [Piers Piers Forster, United Kingdom (of Great Britain and Northern Ireland)]	Noted with thanks.
28934	0				Chapter 10 is currently very repetitive and very disjointed with the same ideas coming up again and again and personally I think could do with some rearranging to make it less unpleasant to read. [Matt Tully, Australia]	Taken into account. The text has been reworked and one of the motivations to do so it to avoid repetitions.
28936	0				The disjointed repetition also results in more or less the same phenomenon being referred to in different ways, ie Hadley cell shifting south, westerlies shifting south, storm track shifting south, SAM increasing … [Matt Tully, Australia]	Taken into account. For the SOD the use of different naming for closely related phenomena, like those mentioned by the reviewer, has been revised to avoid confusion.
54542	0				this chapter covers a huge amount of territory, most of it bvery welcome. It is great, for example, to have section 10.5 on regional messages. It is wonderful to have such integration through much of the chapter of WGI-II concerns and perspectives. [Linda Mearns, United States of America]	Noted.
54546	0				It would be well to review the statements of purpose for the Atlas versus that for Chapter 10. There are some overlaps. Having a clear statement in the intro to Chapter 10 about what is does and doesn't cover compared to the Atlas might be a good way forward. [Linda Mearns, United States of America]	Taken into account. The purpose of Chapter 10 has been re written for the SOD. We have worked together with Atlas to avoid overlaps.
53822	0				At LAM1 and LAM2 we agreed to aim for using a common core set of scenarios across chapters - to the extent possible given the literature. Please keep this ambition in mind for SOD, and check consistency with ch1 and ch4. [Jan Fuglestvedt, Norway]	Taken into account. For the Chapter 10 now contain very little assessments that use scenarios since the case studies of 10.4.3 have (future regional climate change examples) been omitted. In Figure 10.20 RCP8.5 and SSP5-8.5 has been used since those are the ones available for the large ensembles.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
33344	0				Relative to the other chapters, this chapter does less to incorporate paleoclimate perspectives. For instance, Section 10.2.1 does not even include paleo as a potential data source. This was particularly surprising in this chapter, since paleoclimate data often specialize in linking global to regional climate change. [Erika Wise, United States of America]	Accepted. Paleoclimate perspectives have been included where possible.
53840	0				A clearer interface in terms of division of topics and links with ch12 would be useful. [Jan Fuglestvedt, Norway]	Taken into account. The introduction to the chapter has been re-written, and one of the motivations for this has been to clarify how chapter 10 is connected both to the previous and to the following chapters of the report.
32136	0				As a general comment, what is called regional climate in this chap. 10 is too often over land and rarely concerns regional parts of the ocean or regional seas. It means that the regional ocean is neither a forcing nor an object of study in this chapter. This is probably related to the list of authors. [Samuel Somot, France]	Noted. It is correctly interpreted that climate of regional oceans are out of scope for this chapter. However, ocean modes of variability are considered as a forcing for regional climate, this is highlighted all through the chapter.
30114	0				In oder to increase readybility and to avoid confusion, It should be made clear, which climate change case study is based on which methodological approach. For instance, "Attribution past regional climate change and interplay between global and regional dirvers" and "Fully integrated end-to-end case-studies". [Heimo Truhetz, Austria]	Taken into account. To avoid this type of confusions, section 10.4 is now named: "Interplay between anthropogenic change and internal variability at regional scales" while section 10.6 is named: "Comprehensive examples of constructing regional climate messages"
9434	0				This chapter fills an important gap compared to previous IPCC Assessment Reports. It is so important because most people compare the findings related to global cliamte change with their very local experience of climate. And people have a poor understanding what drives local and regional climate variability. It would be helpful to include some introduction to this chapter that puts it into the right context for lay-persons. [Klaus Radunsky Radunsky, Austria]	Taken into account. The introduction to the chapter has been re-written, and one of the motivations for this has been to clarify the objectives of the chapter and to clarify the context to the reader.
44534	0				(Comment submitted to C6, C7 and C10.) The treatment of the processes behind aersol-climate interactions needs to be strengthened through the report. Currently, processes are introduced in Chapter 6 (6.3.1), but only briefly. Then ERF is assessed in Chapter 7, but only globally. In Chapter 10, many regional studies and processes are discussed that rely e.g. on aerosol-precipitation interactions (such as Sahel precipitation trends), but they do not assess the progress in the underlying understanding. My suggestion would be that the process description is strengthened in Chapter 6, up to and including assessments of implications for estimates of regional ERFs and weather/climate interactions. The final assessments for ERF and regional climate can still reside in chapters 7 and 10, but can then refer back to the most recent process litterature in Chapter 6. However other divisions are of course possible, which is why I submit this comment to all three chapters. [Bjorn Samset, Norway]	Taken into account. Ch6 communicated to us that they moved processes to Ch7, but since Ch7 is global, Ch10 now includes processes behind aerosol-climate interaction as well as assessment of their modelling for regional scales.
38128	1	0	133	0	Chapter as a whole, should be consistent in presentation.The text of some sections reads just preliminary where studies are simply listed by authors rather than a integrated assessment with a consise conclusion. Information of models and modelling provide much detailed technical aspects, that make the text reads quite in pieces, is it better to shorten these details and move (some of them) to appendix/annex ? Some blank sub-sections need to be input. Expect a better SOD. [Daoyi Gong, China]	Taken into account.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
29870	1	0	199	0	The regional studies can mainly focus on CORDEX domains, it migth provide more contribution and comparison for literature. Then it can be investigated under more sub-domains soon. [Mustafa Tufan Turp, Turkey]	Rejected. The regions in this chapter are not selected on basis of CORDEX domains, but are selected to serve as examples of the methodologies used to construct regional climate messages. We have made this clearer in the SOD.
46750	1	1	1	1	Executive Summary There is no clear story line or order of messages. For example, regional climate studies are found here and there as well as methodological aspects. [Laura Gallardo, Chile]	Taken into account. Regional climate examples are no longer part of the SOD for the regional climate message per se.
46752	1	1	1	1	Executive Summary Examples of regional climate changes seem to express the nationalities of the authors rather than a systematic review of the literature. A stament on how the assessment was carried out would be useful. [Laura Gallardo, Chile]	Not applicable. ES does not include regional climate changes.
46880	1	1	1	20	Executive Summary Examples of regional climate changes seem to express the nationalities of the authors rather than a systematic review of the literature. A stament on how the assessment was carried out would be useful. [Laura Gallardo, Chile]	Not applicable. ES does not include regional climate changes.
46878	1	1	1	200	Executive Summary There is no clear story line or order of messages. For example, regional climate studies are found here and there as well as methodological aspects. [Laura Gallardo, Chile]	Taken into account. Regional climate examples are no longer part of the SOD for the regional climate message per se.
46928	1	1	1	200	10.2.2.2 Text book? Emphasize assessment instead. Overall shortening recommended [Laura Gallardo, Chile]	Taken into account. In Section 2 has been shortened.
46936	1	1	1	200	Executive Summary There is no clear story line or order of messages. For example, regional climate studies are found here and there as well as methodological aspects. [Laura Gallardo, Chile]	Taken into account. Regional climate examples are no longer part of the SOD for the regional climate message per se.
46956	1	1	1	200	10.2.4.1 In addition to these exemples, how is this interesting research are expected to grow, over which areas and regions? Reference to particular initiatives can be interpreted as showcasing or prescriptive [Laura Gallardo, Chile]	Accepted. Text modified for the SOD.
46958	1	1	1	200	10.2.4.2 Is this worth a section? Stress the need of reliable, high-quality observations for validating cheap sensors. There is a risk of missinterpretation to replace expensive, human intensive high quality observation by cheap sensors [Laura Gallardo, Chile]	Taken into account. A caveat is added in the SOD that the proliferation of cheap sensors needs to be used with caution in climate science to avoid degrading quality.
46960	1	1	1	200	10.3.1.1 Add comparison with CMIP6 models regarding resolution and processes covered. Also discuss the increase in model resolution expected for global models taking into consideration that global forecasting is now provided at resolution comparable to regioinal model.s [Laura Gallardo, Chile]	rejected- the different processes covered by different types of models are given in the technical annex. Here we can only give a superficial account, as space is very limited. Also, even if weather forecasting is providing simulations at the kilometre-scale, climate projections are currently more than a decade away from such resolution. High resolution GCMs at about 20km resolution are already covered extensively.
46962	1	1	1	200	10.3.1.3 Is this worth a section? It makes the reading difficult [Laura Gallardo, Chile]	rejected - these topics need to be covered and a subsection seems the easiest way to do so
46964	1	1	1	200	10.3.1.3.1 It would be considering effort that also include atmospheric chemistry processes at the urban scale. These developments are relevant for characterizing all forcings not just land-use change. [Laura Gallardo, Chile]	rejected- the urban modelling is now covered in a separate box, the material covered has been reduced for space reasons.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46966	1	1	1	200	10.3.1.3 What have we learnt about regional climate simulations since the previous assessment? In addition to more attention, what is different in this report [Laura Gallardo, Chile]	taken into account - the section mentioned is not about regional climate modelling. Anyway, it is amply discussed in the chapter, what we have learned about regional climate modelling. Where applicable, we have discussed advances since AR5.
46974	1	1	1	200	all The text is still patchy and lacking a unifying writing style, which is normal at this stage. However, this must be largely improved in SOD as it will be reviewed more and more by policy makers. Also, many parts are written in a text book style, which can be shortened or referred to. There are multiple technical details on methods and approaches that make it difficult to read. The authors have made an effort in integrating some non traditional dynamical aspects such as SLCF, however, it appears necessary to better coordinate with Ch 6. [Laura Gallardo, Chile]	Taken into account.
38124	1	1	69	1	anthropogenic heat release as a regional driver is important. Should this be added? Or addressed in Drivers, or/and Models / Observation-cities? [Daoyi Gong, China]	Taken into account. This concept is considered in the new urban box included in the SOD
14522	1	1	233	9	I read the outline and the summary, and I feel that this chapter has to be revised substantially, may be rewritten. I think that this chapter should focus on observations. Regional models and simulation should be moved to Chapter 12, with the modeling of the past as a verification and validation of the models, and future projections as the climate scenarios of impact assessment. The observation should more emphases the atmospheric observations especially the long-term surface climate records for major continents and countries. It should inform the readers of key facts and possible causes of regional climate change and variability, including mean climate and extreme climate trends over the past decades to a century, which are the basis of modeling and projection as impact assessment in the following chapters. I could be unable to find this important information. Therefore, this chapter should be restructured to give more attention to the detection and attribution of the long-term changes at regional scales. In this regard, the publications on regional climate change observed in major countries, regions and continents should be carefully collected and read. A lot of such publications, including those for big countries like USA, Canada, mainland China, Europe, Indian and Australia, key regions like Arctic, the Tibetan Plateau, Hindu-Kush-Himalaya, East Asia Monsoon area, the Mediterranean Sea, The Caribbean Sea, and major continents like Asia, North America, Africa and Europe, have mostly been missing. To my surprise, many papers published in some important special issues of international journals (e.g. Climate Change, Climate Research, and Advance in Climate Change Research) on the regional climate change and extreme climate change have not been assessed and cited. I think that the authors should spend much more time to search and summary these publications. I would be glad to review the revised contents of the chapter. (CUG, Guoyu Ren) [Guoyu Ren, China]	Rejected. We are following the outline that was approved by the Panel at its 46th session: https://www.ipcc.ch/site/assets/uploads/2018/09/AR6_WGI_outlines_P46.pdf
43156	1	15	1	15	Last name is spelled wrong. Should be "Bukovsky" - "y" not "i" [Melissa Bukovsky, United States of America]	Accepted. Has been changed for SOD.
49310	1				Chapter 10 could be strengthened with more use of paleoclimate perspectives throughout, e.g. from PMIPs examining GCM performance and from paleoclimate proxy data that elucidate the many regional impacts of past global climate change. Some representative specific ideas are given below. [Yarrow Axford, United States of America]	Accepted. For the SOD the chapter 10 has integrated paleoclimate literature, mostly from PMIP. However the amount of paleoclimate analyses for the regions in sections 4 and 6 are uneven in what is available to each and in what is relevant to the topic covered in each.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30116	6	6	7		Everything that goes beyond "the application of a downscaling method" should be more explicitely mentioned here. This would underpin the sharpness of the AR6. [Heimo Truhetz, Austria]	Accepted, the executive summary has been rewritten and reorganised for the SOD
30118	6	10			Tell what else than observational data and model simulations is required. This would give a better overview and demonstrate competence at the same time. For instance, "In addition to expert knowledge, politcy makers, * and so on * … observational datasets and model simulations are the two main input ..." [Heimo Truhetz, Austria]	Accepted. The list of elements to be considered for the construction of regional climate messages was included in the SOD
30120	6	22			Tell here, what else is needed to verify that a climate model is an adequate source of climate information. [Heimo Truhetz, Austria]	Taken into account. This clarification is not be part of the table of contents, but the minimum requirements for a climate model to be a valid source of climate information have been considered more in depth in the SOD in section 10.3
48062	7	1	7	1	The executive summary is longer than recommended (2 pages) and key messages do not appear in bold. [WGI TSU, France]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
20864	7	1	9	55	Would it be possible to create sub-sections/groups in the executive summary, to e.g. group the case-study statements, as well as the more general ones (at the start), the technical statements and the more service-oriented statements? [Gwenaelle GREMION, Canada]	Taken into account. The executive summary was rewritten using headings and shortened for the SOD
53070	7	1	10	1	The structure of the ES could be reconsidered and developed to have a structure similar to other chapters. It starts out with some general/overarching statements, then turns in to a focus on regions (which is useful). In the middle of the statements on regions there is one on values, learning etc (page 19. l. 26-30) which could be moved to the start or the end of thr ES. [Jan Fuglestvedt, Norway]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
54078	7	3	7	8	The aim of the chapter is not clarified well in the executive summary and is hard to interpret for readers. Based on the first paragraph of executive summary, is it to fill a gap in AR5 as mentioned in line 4 or to construct regional messages based on AR6? [Husain Najafi, Iran]	Accepted. The goal is to fill the gap on the methodologies to generate regional climate change messages from AR5. The executive summary has been rewritten for the SOD
54080	7	3	7	8	In page 10 (lines 35 and 36), it is mentioned that “The main objective of this chapter is to assess the key foundations for the generation of information about regional climate change”. Perhaps one can add a similar sentence in the executive summary. In addition, it is not specified how the chapter is directed to that aim. [Husain Najafi, Iran]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
54082	7	3	7	8	The title of the chapter is “Linking global to regional climate change”. A question perhaps will is raised what part of the regional climate change is considered? Readers might want to know if the chapter is in the scope of detection and attribution of regional studies to provide messages, or regional impact assessment or both? It is suggested that a clarification is added on this. An explanation is provided in Page 10 (lines 23-26) but not in the executive summary. [Husain Najafi, Iran]	Accepted, the executive summary has been rewritten, while shortened, for the SOD. The goal and remit of the chapter has been clarified.
54084	7	3	7	8	The chapter has five main parts. The suggestion is to add some sentences to the first paragraph of the executive summary, how those five parts are inter-related and how those parts, together, will provide regional climate messages. [Husain Najafi, Iran]	Accepted, the executive summary has been rewritten, while shortened, for the SOD. The goal, remit and structure of the chapter has been clarified.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54086	7	6	7	7	“Constructing regional messages goes far beyond the application of a downscaling method, with many complementary emerging approaches.” The sentence is ambiguous. It is better to state clearly what is meant as constructing regional messages first, rather than what it does not mean. Constructing regional messages requires a framework based on literature which seems not included in the chapter. The chapter does not provide any supportive material far beyond the application of a downscaling. [Husain Najafi, Iran]	Accepted, the executive summary has been rewritten, while shortened, for the SOD. We expect the SOD now contains all the supporting material requested
30278	7	7	7	7	Key factors that frame the formulation mentioned in chapter should be detailed [Nazan An, Turkey]	Accepted, the executive summary has been rewritten and reorganised for the SOD
54088	7	10	7	13	Two sentences can be separated in two different paragraphs. Observational datasets and model simulations are introduced as the two main inputs for climate-related decision making but only uncertainties associated with observations is mentioned as an additional source from chain of uncertainties. It is suggested to provide a separate paragraph in executive summary to picture a broader context of uncertainties in the context of chapter. [Husain Najafi, Iran]	Taken into account. For the sake of reducing the executive summary length we might put all the uncertainty information in a single paragraph
46736	7	10	7	13	Executive Summary What is an observational reference? Which is the point to be made [Laura Gallardo, Chile]	Taken into account. An observational reference is a dataset based on observations (gridded observations, reanalyses) that is typically used for model validation.
48282	7	10	7	13	Suggest adding text on scarcity, accessibility and rescue of historical data [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. We had to reduce the length of the executive summary for the SOD and had to sacrifice this interesting addition, which has been included in section 10.2 though
9184	7	15	7	16	Perhaps the most relevant statement in this section is that Paleo-reanalyses provide robust evidence that internal variability is the largest conributor to changes at a regional scale, that likely also to be relevant to the future. [Jim O'Brien, Ireland]	Noted
20856	7	15	7	17	This statement in the executive summary is unclear. "... weak common signal due to external forcing" What type of external forcing is common? Is the external forcing in both the pre-industrial and current period? I referred to section 10.2 to try to clarify the statement, but it is similarly vague (page 32; lines 51-53). [Gwenaelle GREMION, Canada]	Taken into account. It refers to the forcing variability in the pre-industrial period. The text has been rewritten, along with the corresponding text in section 10.2, in the SOD
50970	7	19	7	21	The statement triggers more questions than answers: what is the difference between describing cliamte change features and source of information for adaptation decisions? What diagnostics would be needed for the latter? The statement makes too many thinking steps in one sentence [Bart Van den Hurk, Netherlands]	Taken into account. The text has been rewritten to clarify, among other things, the role of the model evaluation, what is understood by source of information and the links to fitness for purpose
43400	7	19	8	21	Unclear what "intended purpose" is [Saad Amer, United States of America]	Rejected. It is not clear to what piece of text the comment refers to.
20858	7	20	7	22	Would it be possible to reformulate the second (non-bold) sentence into a constructive statement that highlights research needs? [Gwenaelle GREMION, Canada]	Accepted. The executive summary has been completely rewritten for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
31732	7	24	7	27	“There is robust evidence and high agreement that increasing global model resolution can help reduce a number of systematic errors”: this needs a slight caveat that reduction of errors (in the sense of processes being represented incorrectly) does not necessarily lead to an increase in skill (in the sense of the match between projections and actual outcomes) because of compensating errors. It is not clear whether the high confidence cited in this paragraph refers to the process errors or to the overall accuracy of the models. Please clarify. [Martin Juckes, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The sentence referred to the accuracy. The executive summary has been rewritten and reorganised for the SOD.
31734	7	31	7	32	“There is high confidence that including all relevant forcings in RCMs is a prerequisite for reproducing historical trends”: this is a tautology .. unless there is a clear definition of “relevant” which is independent of the contribution to historical trends. The section referenced, 10.3.3, does not have much to say about forcings ... [Martin Juckes, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the executive summary has been rewritten and reorganised for the SOD
52258	7	35	7	35	Hyphen missing in "convection-permitting". [Sergio Henrique Faria, Spain]	Editorial
50972	7	40	7	41	urban climate modelling can hardly be qualified as a purpose on its own [Bart Van den Hurk, Netherlands]	Rejected. It is not clear if the comment requires to remove references to urban climate modelling. Urban climate information is requested by an increasing number of decision makers and the literature on how to produce it is increasing rapidly
39626	7	44	7	44	What does it mean that "statistical downscaling can enhance aspects…"? Could it be more specific? [Carolina Vera, Argentina]	Accepted. It refers to the added value of downscaling that can be demonstrated in certain cases. The text has been changed in the SOD, making emphasis on the challenges associated with the application of statistical downscaling.
54544	7	44	7	46	It might be desirable to modify this statement slightly. Some compound stat downscaling techniques (e.g., muiple linear regression plus weather generators do a fair job and modeling daily precipitation. However, I would agree with the statements regarding spatial fields. [Linda Mearns, United States of America]	Accepted. A full assessment of statistical downscaling methods, including compound methods, is now performed in section 10.3.
50974	7	45	7	45	Difficult to understand the combination of robust evidence and low agreement [Bart Van den Hurk, Netherlands]	Taken into account. It is a valid combination in the uncertainty language, it means that there are many references on the issue, but often they do not agree on the conclusions
27450	7		9		Even in the ES, there is no information about the southern part of the Mediterranean. Please try to avoid reducing the about the Mediterranean region assessment to only the northern part. [Fatima Driouech, Morocco]	Accepted. The treatment of the whole Mediterranean region has been considered in the SOD.
52256	8	1	8	3	Related section is missing. [Sergio Henrique Faria, Spain]	Accepted, it refers to section 10.3; text changed
46882	8	1	8	3	Executive Summary This point is key and in my opinion it should appear earlier. [Laura Gallardo, Chile]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
39628	8	1	8	3	the reference to the section/s underpining the paragraph is missing. [Carolina Vera, Argentina]	Accepted, it refers to section 10.3; text changed
39630	8	5	8	7	I would say that it can enhance the quality of regional climate information. The "value" of a regional climate "message" depends on social dimensions as well. [Carolina Vera, Argentina]	Accepted, text changed
56474	8	9	8	10	This is not surprising, as for "some" regions this will always apply. Better make a statement where precipitation trends will emerge early in the current century. [Christoph Schär, Switzerland]	Taken into account, this point has been dealt with in section 10.4 and the conclusions transferred to the executive summary

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39632	8	9	8	12	wouldn't internal variability continue influencing beyond the end of 21st century under low-level RCPs? [Carolina Vera, Argentina]	Taken into account, the chapter has not considered the period post-2100
48284	8	14	8	54	Suggest considering many or all of these statements to the Atlas. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This is under discussion with the Atlas authors
20860	8	14	9	55	Would it be possible to merge the statement that cover the same region, this could shorten and sharpen the executive summary [Gwenaelle GREMION, Canada]	Taken into account. The text on the future changes was dealt with by the Atlas, while the statements about the past changes were rewritten for the SOD
9738	8	17	8	20	This comment is also relevant to Chapter 10, p95, L9-12. There is some conflicting evidence in Chadwick (2016), where we found that a substantial proportion of the inter-model uncertainty in coupled projections of future West African monsoon precipitation change could be recreated in atmosphere-only simulations without SST pattern change (see Fig. 8 in that paper). Of course, the combination of processes may not be linear, and in coupled projections the uncertainty could be dominated by SST pattern change, but in my opinion there isn't high confidence in this for the West African monsoon as a whole. Park et al (2015b) show a correlation coefficient of 0.71 between future projections of Sahel rainfall change and SST pattern change, so I don't think explaining 50% of the variance for the Sahel is equivalent to dominating uncertainty in West African monsoon projections as a whole. Perhaps a statement like "There is high confidence for the future Sahel precipitation change to be strongly influenced by gradients of SST change between the tropics and North Atlantic..." would be more precise? Chadwick, R. (2016), Which Aspects of CO2 Forcing and SST Warming Cause Most Uncertainty in Projections of Tropical Rainfall Change over Land and Ocean? Journal of Climate 29 (7), 2493-2509 [Robin Chadwick, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, although this part of the executive summary is dealt with by the Atlas
8226	8	34	8	37	Arguably, a similar paragraph on East Africa drying trend over the past decade would be appropriate. It is a hot topic for the region (see "East Africa Climate paradox"). The atlas chapter actually already has some discussion on this see Atlas page30 Line41 [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, although the chapter does not perform an analysis of East African climate. The text on the future changes has been dealt with by the Atlas in the SOD
46884	8	34	8	37	Executive Summary No evidence/studies from other regions in South America? [Laura Gallardo, Chile]	Taken into account. The text on the future changes has been dealt with by the Atlas, while the statements about the past changes have been rewritten for the SOD
46938	8	34	8	37	Executive Summary No evidence/studies from other regions in South America? [Laura Gallardo, Chile]	Taken into account. The text on the future changes has been dealt with by the Atlas, while the statements about the past changes have been rewritten for the SOD
56476	8	39	8	43	Define the term "Eurasian cooling" [Christoph Schär, Switzerland]	Accepted. The term is now defined in section 10.4
32118	8	45	8	46	I think that the sentence could be phrased differently (in a more positive way) to state that « there is high confidence that the decreased anthropogenic aerosol emissions over Europe has (strongly, partly, …) contributed to the enhanced European wummer warming. In particular Nabat [Samuel Somot, France]	Accepted. This type of text has been removed from the executive summary in the SOD
56478	8	45	8	46	I disagree with this conclusion. See detailed comment in respective section. [Christoph Schär, Switzerland]	Accepted. The text has been changed according to the changes in section 10.4
46738	8	1-3	8	8	Executive Summary This point is key and in my opinion it should appear earlier. [Laura Gallardo, Chile]	Accepted, the executive summary has been rewritten, while shortened, for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46740	8	34-37	8	8	Executive Summary No evidence/studies from other regions in South America? [Laura Gallardo, Chile]	Taken into account. The text on the future changes are dealt with by the Atlas, while the statements about the past changes have been rewritten for the SOD
48286	9	1	9	24	Suggest considering many or all of these statements to the Atlas. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text on the future changes is dealt with by the Atlas, while the statements about the past changes will be rewritten for the SOD
48808	9	9			From this page on there are 43 times cited "cities", 4 times "city's";77 times cities; and urban about 200 times. Most of the citations refers "Urban heat Island" (37). As we know most of urban areas are not cities, and many cities presents a low UHI intensity, which can confound the readers. I suggest a major revision using only the term urban areas (instead of cities/city´s) and use the proper term city for tangible examples: i.e. “Asian cities”. [António Lopes, Portugal]	Accepted, the use of urban has been extended in the SOD
46886	9	26	9	35	Executive Summary These refer to methodological aspects, shouldn't this be higher up in the text? [Laura Gallardo, Chile]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
46940	9	26	9	35	Executive Summary These refer to methodological aspects, shouldn't this be higher up in the text? [Laura Gallardo, Chile]	Accepted, the executive summary has been rewritten, while shortened, for the SOD
26980	9	26	9	35	These two paragraphs do not deal with regionsl changes, but with communication of information. Please move them up or down the list, out from in-between "regional" information. [Joachim Rock, Germany]	Accepted, the executive summary has been rewritten and reorganised for the SOD
50976	9	27	9	27	What is "correct context"? It is probably very user specific [Bart Van den Hurk, Netherlands]	Noted. It is very specific. The context is not dealt with in the chapter, just the importance of taking it into account
20862	9	32	9	35	Please consider to include the confidence/likeliness language in this statement [Gwenaelle GREMION, Canada]	Taken into account. The executive summary was rewritten and the confidence language improved in the SOD
32430	9	37	9	48	The points about Cape town and South Asia seem a bit out of order. Perhaps the capetown statement could be moved next to the Asrtalia and South America points and the South Asia point could be moved near East Asia. [Isla Simpson, United States of America]	Accepted, the executive summary has been rewritten and reorganised for the SOD
48288	9	37	9	55	Suggest considering many or all of these statements to the Atlas. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The text on the future changes is dealt with by the Atlas, while the statements about the past changes will be rewritten for the SOD
56480	9	50	10	1	As currently formulated, this is not surprising. Virtually all land-areas warm faster than the respective hemispheric mean. The assessment should be substantiated or removed. [Christoph Schär, Switzerland]	Accepted. The text has been changed according to the changes in section 10.4
32432	9	51	9	53	“than the NH” (which occurs twice) seems to vague since the Mediterranean is in the NH. Perhaps “than the NH average”. [Isla Simpson, United States of America]	Accepted, text changed
32434	9	53	9	53	It seems strange to have a statement about the summer precipitation in the Mediterranean but nothing about winter. [Isla Simpson, United States of America]	Taken into account. We have removed the statement about the summer precipitation because the case study deals only with summer warming
46742	9	26-35	9	9	Executive Summary These refer to methodological aspects, shouldn't this be higher up in the text? [Laura Gallardo, Chile]	Accepted, the executive summary has been rewritten, while shortened, for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45516	10	4	17	10	The chapter and particularly the first section are framed around the concept of "regional climate messages" instead of "regional climate information". I find this confusing and not very consistent with the title of the chapter. The use of "message" suggests that information is contructed and gives a sense of subjectivity. While I would not discuss whether this is true or false, most of the tools use to generate regional climate information are as objective as those use to generate global information. However, we don't really refer to global climate messages. Moreover, I couldn't find any other reference to "regional climate messages" in other chapters. The discussion on "regional climate messages" seems appropriate for some subsection and particularly when linking with chapter 12 but I don't see why it should be used to frame the whole chapter. [Di Luca Alejandro, Australia]	Taken into account. The revised version explains the difference between climate “information” and “message” taken from section 10.5 where the message is an object resulting from the interaction with the user and links our chapter with the storyline strategy to be followed in WGI.
52270	10	4	19	19	The first sections of the chapter already deal with assessments that should be reported using the IPCC calibrated uncertainty language. Nevertheless, a systematic use of the calibrated language (after the Executive Summary) starts only in Box 10.1. Before that, I could identify only two uses of the calibrated language on Page 16, Lines 21 and 34. [Sergio Henrique Faria, Spain]	Taken into account. We make a more thorough use of the calibrated language in the chapter, although section 10.1 is introductory and little assessment is done there.
54090	10	13	10	51	Methods and new data bases are going to be presented in other chapters (e.g. chapter 11) compared to AR5. It is suggested that appropriate explanation be provided for comparison between AR5 and AR6. If AR6 result will be provided in the second-order-draft (SOD), it is better to state that in this version as well. [Husain Najafi, Iran]	Noted, although it seems that the comment should make reference to CMIP5 and CMIP6
20866	10	17	10	20	the scales could be further improved throughout these sentences to ensure consistency, first it discusses up to city scale, but in the end it refers to 'decision scale at the regional level'. Possibly this could be already improved by adding 'regional-to-local level'. [Gwenaelle GREMION, Canada]	Accepted, text changed
42432	10	23	10	24	reference to Roessler et al. (2017) missing.Roessler O, Fischer AM, Huebener H, Maraun D, Benestad R, Christodoulides P, Soares PMM, Cardoso RM, Pagé Ch, Kanamaru H, Kreienkamp F, Vlachogiannis D (2017) Challenges to link climate change data provision and user needs - perspective from the COST-Action VALUE. International Journal of Climatology. DOI: 10.1002/joc.5060 http://onlinelibrary.wiley.com/doi/10.1002/joc.5060/epdf [Rita M Cardoso, Portugal]	Accepted, the reference has been added
39634	10	23	10	33	There is no mention to the fact that two more elements are needed for the "regional message construction", the knowledge about the regional climate and knowledage about the human dimensions of the climate related problem. While the former is needed to manage uncertainties associated with both observations and models, the latter is needed to orient/shape the message. [Carolina Vera, Argentina]	Accepted. Section 10.1 in the SOD has clearer definitions for the elements needed to construct regional climate messages, including the two elements mentioned. The new fig 10.1 tries to illustrate these elements
20868	10	24	10	24	Kushnir et al. 2019 (Towards operational predictions of the near-term climate. Nat. Clim. Chang. 94–101, doi:10.1038/s41558-018-0359-7) have published a single paper and thus there is no need to have "2019a" here. Also, please remove one of the identical citations in the list of references (i.e., page 165 line 56 to 57) [Gwenaelle GREMION, Canada]	Editorial
56038	10	24	10	24	Ref Kushnir et al 2019a points to the same paper as Kushnir 2019b. [Corti Susanna, Italy]	Editorial
20870	10	33	10	33	Would it be a good idea to add the following behind the sentence?: ´, to get to the core of the data.´ [Gwenaelle GREMION, Canada]	Rejected. It is not about data but information, which goes well beyond just the data.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20872	10	35	10	36	Possibly start with this sentence in the second paragraph to have the aim of this chapter clear from the start and don't leave the reader hanging for two paragraphs [Gwenaelle GREMION, Canada]	Accepted. The sub-section was rewritten for the SOD
46888	10	35	10	40	10.1.1 There is also connections to chapters describing processes, Ch 6 in particular. [Laura Gallardo, Chile]	Accepted, this chapter is connected to many other chapters
54092	10	35	10	40	Assessing methods and approaches is not enough for constructing regional messages tailored for decision scale of policy and adaptation communities. In order to do so, a framework is required to fulfill the aim of the chapter perhaps based on an existing literature on a general framework. [Husain Najafi, Iran]	Accepted. The SOD text considers a framework, described in section 10.5, for which references have been added.
20874	10	38	10	38	Do we need to mention ´IPCC reports´ instead of ´reports´ only? [Gwenaelle GREMION, Canada]	Accepted, text changed
20876	10	39	10	39	After reading ´in a more systematic way´ I wondered how? Why is this more systematic than previous chapters? Would it help by adding ´, by ...´ behind this sentence? [Gwenaelle GREMION, Canada]	Accepted. The sentence has been rewritten
48920	10	39	10	40	Should Chapter 6 be added to this list of chapters addressing aspects of regional climate change? [Chaincy Kuo, United States of America]	Accepted, a list of chapters has been added
53812	10	40	10	40	I hope there are strong connections to chapter 4 as well. [Jan Fuglestvedt, Norway]	Accepted, a list of chapters has been added
30748	10	42	10	42	Not sure section 10,1 accomplish this objective. Subsections are dispersive and not well focused, despite the titles [Annalisa Cherchi, Italy]	Accepted, section 10.1 has been rewritten and better aligned with the other sections to serve as an introduction
20878	10	42	10	42	What about adding behind the first sentence: background information on ...(explanation) [Gwenaelle GREMION, Canada]	Accepted, text changed
20880	10	45	10	45	Is the word ´also´ needed here? (3rd word in the sentence) [Gwenaelle GREMION, Canada]	Rejected, yes it is needed
46890	10	46	10	46	10.1.1 It is not a matter of "credibility" of projections, rather accuracy [Laura Gallardo, Chile]	Rejected. It is not possible to estimate the accuracy of the projections
44554	10	52			This section sould probably also link to the model development part of Chapter 1. You conclude (in your ES) that Climate models have improved representation of ocean and cryosphere processes and higher resolution, increasing model diversity (high confidence) and reducing model biases (medium confidence)." It would be good if you could verify that the relevant improvements are adequately dealt with in section 1.4.3. [Bjorn Samset, Norway]	Accepted, the SOD text has been checked against the corresponding sub-section in chapter 1.
9996	10	54	10	54	relevant for this paragraph:Authors should consider that there is a general framework for studying climate response to forcings also a regional scale based on statistical mechanics.see Lucarini et al. J. Stat. Phys. 166, 1036 (2017) [Valerio Lucarini, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, but not including the reference because, although very interesting, the concept is not fully developed at the regional scale
50978	10	54	12	25	Although this material is good and correct, it has quite some generic statements that belong to a text book on climate change and may be left out of this AR [Bart Van den Hurk, Netherlands]	Rejected. The discussion of key concepts and definitions as part of framing the chapter is needed to provide contextual statements.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39636	10	54	15	32	One definition that is missing is the "climate information" definition. What is regional climate information in this report? observed data and/or model outputs and/or climate knowledge? or what is relevant for the user? or all of them? "climate information" does not mean the same to everybody, and sometimes is even confused with the "message". [Carolina Vera, Argentina]	Taken into account. The chapter's Preamble (10.1.1) and its accompanying Figure 10.1 address this comment. We recognize in both that there is a multiplicity of sources for climate information. We also recognize in the text that what constitutes climate information is dependent on specific needs and interests of users. Figure 10.1 also points to further sections of the chapter than expands on theses points, especially sections 10.5 and 10.6, and it points to later chapters and the Atlas for further details on climate information.
20882	11	1	11	1	To which system does the ´global coupled atmosphere-ocean-land-cryosphere system´ refer? Is this from the Unified Modeling Approach to Climate System? Should this be more clarified? [Gwenaelle GREMION, Canada]	Reject, the system has been introduced in previous chapters
20884	11	3	11	3	Please consider to inclue the reference: 'Seamless prediction of the Earth system: from minutes to months', WMO ; 2015 978-92-63-11156-2 (https://library.wmo.int/index.php?lvl=notice_display&id=17276#.XQO53SaxXOH) [Gwenaelle GREMION, Canada]	Rejected. This reference talks about the use of a seamless approach for short climate time scales
46892	11	11	11	20	10.1.2.1 Fig 10.1 It refers to dynamical processes? What about regional and geaseous aerosol forcings or land and vegetation interactions? [Laura Gallardo, Chile]	Taken into account. We have discussed with Chapter 1, and the component of Ocean, Land etc. has been included in the Figure in Chapter 1.
32436	11	17	11	17	“At the spatial scale” is not very clear. At what spatial scale is this referring to? [Isla Simpson, United States of America]	Accepted, text revised
46894	11	27	11	39	10.1.2.2 The time scales discussed here could be highlighted in Fig 10.1 [Laura Gallardo, Chile]	Rejected: As the figure include so many information here, please read the time-scale discussed in 10.1.2.2 from existing Y-axis.
46942	11	27	11	39	10.1.2.2 The time scales discussed here could be highlighted in Fig 10.1 [Laura Gallardo, Chile]	Rejected: As the figure include so many information here, please read the time-scale discussed in 10.1.2.2 from existing Y-axis.
20886	11	28	11	28	Would it be better to change ´the idea of´ into ´the inventive way of´ ? [Gwenaelle GREMION, Canada]	Taken into account: Text revised
53814	11	28	11	34	Figure 10.1 is very useful. [Jan Fuglestvedt, Norway]	Noted, with thanks
8970	11	28		32	Define the model acronyms [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Explanation of all acronyms has been inserted in the Figure.
42434	11	40	11	43	topgaphy is also a significant climate forcing. From global to regional and local scales. [Rita M Cardoso, Portugal]	Noted
20888	11	41	11	41	There is no need to write "etc" inside the parentheses. Also, it is recommended to add "volcanic activity" and "wildfire" after solar radiation as some of potential large-scale (human-being involved) forcing. [Gwenaelle GREMION, Canada]	Accepted, etc has been removed. Accepted: volcanic activity has been added. Rejected: wild fire is not considered a large scale forcing.
43406	11	41	11	42	etc. is omitted [Saad Amer, United States of America]	Accepted, "etc" has been removed
7670	11	47	11	47	The definition of the regional scale itself is ambiguous as it covers space scale from sub-continent to local scale but the distinction between global and regional is usually clear. "and its distinction from the global scale" could be deleted to avoid confusion. [isabelle gouirand, Barbados]	Accepted, text revised

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42436	11	47	11	54	There is also regional modeling at continental scale, e.g. CORDEX. Regional scale modeling is usally considerd when the bondary conditions come from a global or hemspheric model. [Rita M Cardoso, Portugal]	Noted
46976	11	56	12	12	10.1.2.1 Eventhough each continent is considered (except Antarctica), the selection seems to reflect the procedence of authors rather than a systematic review of the literature. Also, as the continents have multiple and distinct climate regions, it would be much useful to extend the review to the available literature, and use the example to illustrate different types of phenomena(expansion of the Hadley cell, urbanization, etc) rather than hand picked zones. South America, for instance is not represented by La Plata Basin or the Amazon. Dramatic changes along the Andes or in the tropics are also of concern, and there is literature to be reviewed, e.g. Boisier et al (https://www.elementascience.org/articles/10.1525/elementa.328/) [Laura Gallardo, Chile]	Taken into account. This is not a review, the case studies have been chosen on the basis of the capability available and the section only introduces the problem; later sections get into more detail.
7672	12	1	12	1	" a number of examples have been considered". Does this refer to the thirteen case studies mentioned on line 2?. If yes " a number of examples have been considered" and could be replaced by "thirteen cases have been considered. They are representative of ." to facilitate the reader. [isabelle gouirand, Barbados]	Not applicable: by the inclusion of the Box 10.2 the number of examples have increased to over thirty, we formulated this differently in the caption now.
20890	12	1	12	8	Possibly this paragraph could be merged with the 10.1.1 last paragraph, as it covers similar content. [Gwenaelle GREMION, Canada]	Accepted, the text that overlaps with 10.1.1 last paragraph has been removed
20892	12	2	12	2	Would it be good to add ´almost´ before all continents, if you write except the antarctic behind it? [Gwenaelle GREMION, Canada]	Accepted, "almost" has been added
20894	12	13	12	13	What about defining the end-to-end focus and how this solution is generated? Is the word ´region´ behind end-to-end focus right in this context? [Gwenaelle GREMION, Canada]	Taken into account; in the SOD we have renamed the "end-to-end case studies" as "Comprehensive examples of constructing regional climate messages", which we hope gives a much clearer idea of what is intended to cover. We also provide a schematics on "approaches to constructing regional messages" with the hope to help the reader to understand the purpose of the different regions of Figure 10.2.
56040	12	16	12	39	This is about the definition of the baselines and the differences with respect to chapters 1-9. I totally agree that it is necessary here to be flexible in the definition, due to the various sources of information used for the case studies and the distillation of the information. However it is very important to properly highlight when and where the baselines are different from those defined in the other chapters. To avoid misunderstandings. I would suggest highlighting different baselines and/or using tables [Corti Susanna, Italy]	Taken into account. However consider that the reference periods referred to throughout this chapter are clearly defined and do not conflict with the terminologies associated with past and future baselines used in Chapters 1-9. Also consider that other regional chapters refer to varying reference periods.
7674	12	19	12	20	add "cross" after blue and "in grey" could be replaced by "are delimited by rectangles" to clarify the legend [isabelle gouirand, Barbados]	Not applicable, figure and legend have been changed.
52264	12	25	12	50	The first two paragraphs of Sect. 10.1.2.2 are a bit confusing. They tend to suggest the implicit assumption of a space-time correlation among scales (reinforced by Fig.10.1), while at the same time they warn against that (cf. references to Frankcombe et al. and New et al.). Also the description of the study by Muñoz et al. is vague and dificult to follow. [Sergio Henrique Faria, Spain]	Accepted. Text is revised by deleting one of the statements on trends at a smaller spatial scales.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30750	12	25	13	39	not clear what kind of assessment has been done in this subsection. Paragraphs are quite dispersive, is this subsection needed given the information in ch 1? [Annalisa Cherchi, Italy]	Taken into account. No assessment is presented here as this section is primarily aimed at framing concepts and providing context for subsequent sections. Where useful Ch.1 is referenced.
20896	12	28	12	28	Would it be possible to avoid Lovejoy (2013) twice behind eachother? [Gwenaelle GREMION, Canada]	Accepted, first usage deleted.
20898	12	28	12	28	The indicated citation for Lovejoy (2013) has to be modified on page 169 line 39 as follows: Lovejoy, S. (2013). What is climate?. Eos Trans. Amer. Geophys. Union 94, 1-3. [Gwenaelle GREMION, Canada]	Accepted, the citation has been revised.
20900	12	36	12	36	To which scale does ´relatively short´ refer? [Gwenaelle GREMION, Canada]	Noted. This does not refer to a specific timescale but to the insufficiency of the observational data in relation to the questions being addressed (even at multiple scales).
32438	12	36	12	36	It is true that there is only one realization of internal variability for the actual climate, but there are attempts being made to produce “observational large ensembles” e.g., McKinnon and Deser (2018), J. Clim., 31, 6783-6802. Papers such as this are mentioned in other parts of the chapter. Perhaps a mention here would also be appropriate. [Isla Simpson, United States of America]	Accepted, the reference has been added.
50980	12	46	12	46	one , too many [Bart Van den Hurk, Netherlands]	Accepted, ","removed.
52262	12	46	12	46	Remove extra comma. [Sergio Henrique Faria, Spain]	Accepted, ","removed.
44172	12	46	12	46	Doble comma [Ramiro Saurral, Argentina]	Accepted, ","removed.
43408	12	46	12	48	Confusing/gramatically incorrect. For instance, Munoz et al. (2015) used extreme rainfall characteristics (e.g. frequency, intensity, location) to highlight that different climate drivers have their own imprints and that they tend interact with each other. [Saad Amer, United States of America]	Accepted, sentence revised.
52266	12	48	12	48	"Skills" instead of "skill". [Sergio Henrique Faria, Spain]	Rejected, original text is grammatically correct.
20902	12	48	12	50	Will it be possible to add a tiny indication of lead time and lagged-time? Since the remarkable benefits associated with the large-scale climate drivers would be their capabilities to predict (or inform) with some time lags. [Gwenaelle GREMION, Canada]	Accepted
32440	13	2	13	2	I’m not entirely sure what “nonlinear atmospheric variability” is referring to here, but I think that decadal variability can appear just through randomly sampling of a stochastic process. For example, this is argued by Wunsch (1999), BAMS, 80, 245-255. Perhaps the fact that decadal variability can appear as a result of the random sampling of higher frequency variability should be mentioned. [Isla Simpson, United States of America]	Rejected. The argument regarding decadal variability appearing through random sampling of a stochastic process is not relevant to the discussion presented that speaks to the influences on regional climate change at multiple timescales.
20904	13	5	13	5	´The interplay of internal and forced variability of different time scales´ is a bit unclear, what is really meant by this? [Gwenaelle GREMION, Canada]	Taken into account. Interplay means combination of causes i.e. the combination of variability at different timescales is important for climate prediction. This has been made clearer in the SOD.
20908	13	6	13	6	What meant by ´near-term´ in this context? [Gwenaelle GREMION, Canada]	Accepted. Near-term is reworded here as to not conflict with other uses in the report.
20906	13	6	13	7	´The phase of the internal multi-annual variability in the context of changing external factors´ is somewhat vague or unneccesarily complex put. Could this be described in a more clear way? Are the changing external factors also multi-annuel? [Gwenaelle GREMION, Canada]	Accepted, the sentence has been revised.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46896	13	9	13	14	10.1.2.2 Moreover, long-standing climate changes can trigger chains of effects in complex and interconnected systems (eg., doi: 10.1146/annurev-environ-110615-085349; doi: 10.5194/hess-21-6307-2017) [Laura Gallardo, Chile]	Noted
43410	13	9	13	14	The coumpounding impacts of climate change can further add up such that drought, agricultural insecurity and and livestock mortalityresult in migration and regional conflict. In Syria, as many as 1.5 million people from fled from rural farming areas to the peripheries of urban centers, exacerbating the Syrian War. Climate Change and the Eecent Syrian Drought. Colin P. Kelley, Shahrzad Mohtadi, Mark A. Cane, Richard Seager, Yochanan Kushnir Proceedings of the National Academy of Sciences Mar 2015, 112 (11) 3241-3246; DOI: 10.1073/pnas.1421533112 [Saad Amer, United States of America]	Accepted. Text has been revised to incorporate.
20910	13	10	13	10	What about changing ´true not just because´ into ´true, both because..´? [Gwenaelle GREMION, Canada]	Rejected, the original phrasing seems ok
50982	13	18	13	18	is this 1995-2014 baseline consistent with the baseline in the Atlas chapter and other sections of the report? [Bart Van den Hurk, Netherlands]	Noted. The original sentence indicates that the baseline used in Chapters 10-12 and Atlas may vary from the 1995-2015 baseline used in Chapters 1-9.
20912	13	18	13	18	Is this recent scale still recent? [Gwenaelle GREMION, Canada]	Noted. Yes, that is the case, and it allows for comparisons with previous assessment reports and between available model and observational datasets. In these contexts the period is recent.
7676	13	23	13	25	sentence not clear, could be rephrased [isabelle gouirand, Barbados]	Accepted, the sentence has been revised.
42438	13	28	13	29	Missing reference Giorgi et al. (2009). Giorgi F, Jones C, Asrar GR (2009) Addressing climate information needs at the regional level: the CORDEX framework. Bull World Meteorol Organ 58:175–183 [Rita M Cardoso, Portugal]	Noted. The text indicates that the statements made are based on recent literature.
42440	13	36	13	37	in the "fixed global mean temperature change from the pre-industrial" example add: Kjellström et al., 2018 for Europe; Nikulin et al. 2018 for Africa. Kjellström, E., Nikulin, G., Strandberg, G., Christensen, O. B., Jacob, D., Keuler, K., Lenderink, G., van Meijgaard, E., Schär, C., Somot, S., Sørland, S. L., Teichmann, C., and Vautard, R.: European climate change at global mean temperature increases of 1.5 and 2 °C above pre-industrial conditions as simulated by the EURO-CORDEX regional climate models, Earth Syst. Dynam., 9, 459-478, https://doi.org/10.5194/esd-9-459-2018, 2018; Nikulin, G., Lennard, C., Dosio, A., Kjellstrm, E., Chen, Y., Hnsler, A., et al. (2018). The effects of 1.5 and 2 degrees of global warming on Africa in the CORDEX ensemble, Environmental Research Letters, 13 (2018), 065003. https://doi.org/10.1088/1748-9326/aab1b1. [Rita M Cardoso, Portugal]	Accepted. The reference for Europe is added. Since a reference is already noted for Africa, references for the Caribbean and South America are also included.
44174	13	37	13	37	Another example (but for water availability over South America) can be found in Montroull et al. (2018) [Montroull, N., R. Saurral, and I. Camilloni, 2018: Hydrological impacts in La Plata basin under 1.5°C, 2°C and 3°C global warming above the preindustrial level. Int. J. Climatol., 38, 3355-3368.] Note that this paper is already referenced later on in the chapter [Ramiro Saurral, Argentina]	Accepted. The additional reference has been added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48814	13	42			High/low /medium confidence and robust evidence does not appear in chapter 10 (as far as I know). Please refer to cap 1 Box 1.1 fig. 1.1 (if these are the same in the whole text). [António Lopes, Portugal]	Rejected. The argument regarding decadal variability appearing through random sampling of a stochastic process is not relevant to the discussion presented that speaks to the influences on regional climate change at multiple timescales.
48816	13	42			please include quantitative criteria to define de levels of confidence. That would be appreciated by the reader in 10.1.2.3 [António Lopes, Portugal]	Noted
46898	13	44	13	46	10.1.2.3 Stress that the evalution of any model simulation must be designed also according to the purpose of the simulation. For instance, evaluating a regional model for characterizing changes in precipitation frequency is different than evaluating it for, say, characterizing extremes, or temperature [Laura Gallardo, Chile]	Accepted, the text has been changed with a link to section 10.3, which is where fitness for purpose is assessed, for the SOD
46944	13	44	13	46	10.1.2.3 Stress that the evalution of any model simulation must be designed also according to the purpose of the simulation. For instance, evaluating a regional model for characterizing changes in precipitation frequency is different than evaluating it for, say, characterizing extremes, or temperature [Laura Gallardo, Chile]	Accepted, the text has been changed with a link to section 10.3, which is where fitness for purpose is assessed, for the SOD
42444	13	49	13	49	add reference Kotlarski et al., 2017 Kotlarski S, Szabó P, Herrera S, Räty O, Keuler K, Soares PM, Cardoso RM, Bosshard T, Pagé C, Boberg F, Gutiérrez JM, Isotta FA, Jaczewski A, Kreienkamp F, Liniger MA, Lussana C, Pianko-Kluczyńska C (2017) Observational uncertainty and regional climate model evaluation: A pan-European perspective. International Journal of Climatology. DOI: 10.1002/joc.5249 http://onlinelibrary.wiley.com/doi/10.1002/joc.5249/full [Rita M Cardoso, Portugal]	Accepted, the reference has been added to the SOD
50378	13	54	14	1	I don't think the paper Booth et al., (2013) is the best to refer to when it comes to future regional climate information, since this paper is looking into global mean change. Hawkins and Sutton (2009) is more appropriate. Moreover, it would fit to introduce the "Cascade of uncertainty" at this point. It is mentioned further down in the text (line 8 p14), but could be introduced here. See Mitchell T D and Hulme M (1999) [Predicting regional climate change: living with uncertainty Prog. Phys. Geog. 23 57–78]; Wilby R L and Dessai S (2010) [Robust adaptation to climate change Weather 65 180–5] [Silje Soerland, Switzerland]	Taken into account, additional references have been introduced in this sub-sub-section.
36642	13	55	14	10	I think it would be worth explicitly metioning spatial resolution here as an element of structural model uncertainty. I would follow "inability to accurately describe known processes" with "due to model limitations such as spatial resolution." [Seth McGinnis, United States of America]	Taken into account; model resolution is one of the factors that limit the representation of known processes, while others can be the lack of good estimates for the coefficients in the parameterisations
54094	14	1	14	5	There was an ECMWF/WWRP workshop on model uncertainty in 2016. In the proceeding document of the workshop (available online from https://www.ecmwf.int/sites/default/files/elibrary/2016/16551-ecmwfwwrp-workshop-model-uncertainty-proceedings.pdf), there was a working group which addresses “the sources of model error and how can we improve the physical basis of model uncertainty representation”. It is suggested to add the relevant discussions based on this document to improve this part. [Husain Najafi, Iran]	Noted
46900	14	1	14	16	10.1.2.3 Consider illustrating the uncertainty cascade. [Laura Gallardo, Chile]	Noted
46946	14	1	14	16	10.1.2.3 Consider illustrating the uncertainty cascade. [Laura Gallardo, Chile]	Noted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50984	14	7	14	7	I am not sure whether this statement about model uncertainty being the largest uncertainty source can be considered as a general statement. Literature emphasising natural variability (for precipition) and projections for far futures (forcing uncertainty) demonstrate other dominant sources of uncertainty [Bart Van den Hurk, Netherlands]	Accepted. The sentence has been changed by removing "the largest", new references have been added and the role of internal variability duly recognised
14076	14	7	14	7	May simply the statement 'from one region and variable to another' -> 'according to regions and variables' [Jinwon Kim, Republic of Korea]	Accepted, text changed
14548	14	7	14	10	Could this sentence be more specific about if model uncertainty is relatively more important at the regional scale compared to larger scales and the global average? [Stefan Fronzek, Finland]	Accepted, the text was changed in the SOD to make clear that the uncertainty tends to be larger at regional scales
14550	14	7	14	10	It may be worth stating that the relative imortance of different sources of uncertainty varies over time, despite that may seem obvious to some. [Stefan Fronzek, Finland]	Accepted, text was changed in the SOD adding new references
30752	14	10	14	10	"However" is not well placed [Annalisa Cherchi, Italy]	Accepted, text changed
54548	14	10	14	12	Something is wrong with this sentence. Needs completion. [Linda Mearns, United States of America]	Accepted, the sentence has now at the end "that fully take into account all the variability sources"
32442	14	10	14	12	I wouldn't say that the availability of large ensembles have illustrated how important it is to obtain reliable estimates of climate projections. I think before large ensembles, we knew it was important to obtain reliable estimates of climate projections. What large ensembles have illustrated is that there is a substantial irreducable uncertainty in our climate projections due to internal variability and that if we want to know the true externally forced response, it is likely that it will be impossible to do so in the real world and that we need a large number of ensemble members in model world. [Isla Simpson, United States of America]	Taken into account, the fact that the role of the internal variability was known before but is now better illustrated has been made clearer in the SOD in several parts of the text
50380	14	12	14	14	I would rephrase this sentence, since in Sørland et al. 2018, the two first elements in the sentence is not discussed in detail, but it is rather shown that the traditional assumption about the cascade of uncertainty is not necessarily correct. [Silje Soerland, Switzerland]	Accepted, the text has been changed in the SOD
50382	14	15	14	16	What does contribute to modify the overall confidence mean? Is the confidence larger or smaller ? [Silje Soerland, Switzerland]	Taken into account; the response is that it depends on the situation, the uncertainty chain is nonlinear
54096	14	19	14	23	It is suggested to add some citations. [Husain Najafi, Iran]	Noted
42442	14	27	14	27	Update reference to Abramowitz (2019). Abramowitz, G., N. Herger, E. Gutmann, D. Hammerling, R. Knutti, M. Leduc, R. Lorenz, R. Pincus, and G.A. Schmidt, 2019: Model dependence in multi-model climate ensembles: weighting, sub-selection and out-of-sample testing. Earth Syst. Dynam., 10, 91-105, doi:10.5194/esd-10-91-2019. [Rita M Cardoso, Portugal]	Accepted
50986	14	29	14	29	"when synthesized": this is an unclear statement [Bart Van den Hurk, Netherlands]	Accepted, the idea of synthesis has been expanded
56042	14	35	14	44	The notion that message is a function of contest (or that knowledge is information in contest) might need to be a bit expanded here and made more evident using examples. I do agree very much with these statements, however they could be easily translated in a statement of "generic relativeness" of the information (or knowledge), that it is not what is intended, nor what we want. I would expand a bit these concepts here in the foundations sections rather than reiterate them later on in section 10.5 [Corti Susanna, Italy]	Accepted. The text has been changed, always in agreement with the material included in 10.5, but trying to strike a better balance between sections 10.1 and 10.5

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32120	14	35			reducing the « regional climate change » to the « regional climate messages » targeting adaptation and policy-relevant scale is too narrow. I miss a section listing the whole range of knowledge and applications based on regional climate studies. For example, better understanding the past variability of regional climate phenomena such as tropical cyclones or regional winds is also of interest. Regional climate studies target at the same time knowledge increase and the policy-relevant information [Samuel Somot, France]	Accepted. Section 10.1 has a sub-section on drivers that clarifies the need to target both adaptation and knowledge increase about the physical changes in the climate system
50988	14	37	14	37	"messages communicate knowledge based on data": unclear sentence, gives rise to many (philosophical) questions [Bart Van den Hurk, Netherlands]	Accepted, the role of the messages in the whole process has been clarified
46902	14	38	14	44	10.1.3 Are these categories of issues based on the authors's experience or is it derived from the literature? Are these the only issues to be considered? What about the question of opportunity in knowledge provision? The whole question of climate services also requires of timely information for decision making. Moreover, information should be given in an increasingly fit for purpose manner. [Laura Gallardo, Chile]	Accepted. In the SOD we have explained the origin of the list, which is based on material written in section 10.5. The list has been expanded and the opportunity of knowledge provision been mentioned. Fitness for purpose is assessed in section 10.3.
50990	14	44	14	44	this listing is obscure. I wonder what reasoning is used to have this listing, in which "resolution" appears at a similar categorization level as "construction of messages". This categorization needs to have a better justification [Bart Van den Hurk, Netherlands]	Accepted. In the SOD the origin of the list, which is based on material written in section 10.5, has been explained and reasoned. Resolution is not at the same level as the construction of messages. Figure 10.1 helps to understand what the role of the different elements is.
39020	14	47	15	32	Discussion is abstract and may not be easy to follow. A few references may help. [Masahide Kimoto, Japan]	Accepted, response accommodated as per comment 39020
39638	14	47	15	32	There is no single reference included in this sections. As assessment like this one, should include references to available literature. [Carolina Vera, Argentina]	Accepted, response accommodated as per comment 39020
46904	14	49	14	54	10.1.3.1 These statements are probbzly derived from the climate service literature. Please quote the said literature. [Laura Gallardo, Chile]	Accepted; this is an introduction to section 10.5, which is where all the required references will be found
46948	14	49	14	54	10.1.3.1 These statements are probbzly derived from the climate service literature. Please quote the said literature. [Laura Gallardo, Chile]	Accepted; this is an introduction to section 10.5, which is where all the required references will be found
50992	14	49	15	7	Also this text has underlying assumptions that are important but not made explicit. "Regional climate messages" needs a proper definition: by whom, about what topic, with what purpose. I guess the authors imply instances that give science-based information on regional climate change for some application involving societal information provision [Bart Van den Hurk, Netherlands]	Accepted, response accommodated as per comment 39020
46744	14	1-16	14	14	10.1.2.3 Consider illustrating the uncertainty cascade. [Laura Gallardo, Chile]	Noted
48290	15	4	15	4	The last phrase in the sentence, "formulated … adaptation plans" is not relevant here as they do not constitute "regional climate messages". [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Rejected. National climate adaptation plans contain some of the most complete regional climate messages; this is explained in section 10.6 in the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50994	15	10	15	32	although the rationale is well perceived, this text contains a lot of statements on what kind of actions are not recommended but no suggestions on how to go ahead. Also there are no literature statements supporting the assertions [Bart Van den Hurk, Netherlands]	Taken into account. See also response to comment 39020. The SOD includes revised text in 10.1 and 10.5 with new figures to speak to options for moving ahead to complement the recommendations of what should not be done. The revisions do not provide a recipe or prescriptive statements on what should be done, but rather highlight what needs to be understood and accommodated in the development of climate messages.
54550	15	14	15	16	Might be good to explain to the reader why this is the cae. [Linda Mearns, United States of America]	Taken into account, the SOD revision explains this more clearly with supporting reference.
9344	15	14	15	16	Even if invalidity is well established, quoting a reference would be welcome [philippe waldteufel, France]	Taken into account, the SOD revision explains this more clearly with supporting reference.
56044	15	27	15	32	As above, I think that the notion should be somehow better clarified… there is the risk of misunderstanding [Corti Susanna, Italy]	Taken into account. The SOD removes ambiguity and includes revision in text in 10.5, as well as 10.1, and a new figure to help the reader gain quick access to these, and it cites new literature subsequent to the FOD (for example Jack et al.)
15378	15	35	18	43	There is nothing about large-scale influence of mountain ranges, which can prevent moving of air masses, block precipitation etc., like wet western slopes and dry eastern, more cold climate of northern slopes and more warm of southern. And climate in large mountainous regions like Tibet, Tien-Shan etc. is strongly affected by elevation. Please add a paragraph about the influence of large mountain ranges and systems on forming of the regional climate. [Oksana Lipka, Russian Federation]	Rejected - due to space constraints we cannot discuss general determinants of regional climate such as mountain ranges.
46906	15	38	15	38	10.1.4 Which other drivers in addition to natural and anthropogenic (radiative) forcings? Make it explicit or exemplify [Laura Gallardo, Chile]	Accepted, "and other drivers" has been removed
46908	15	46	15	50	10.1.4.1 Repetition? Special section not needed [Laura Gallardo, Chile]	Accepted, the introduction lines to 10.1.4.1 have been removed
32122	15	46			l'm not sure the whole list of forcings can be really considered as « external forcings ». For example GHG and natural aerosols could be considered as part of the regional climate system. [Samuel Somot, France]	Rejected, not clear what is meant
53816	15	48	15	50	The authors may consider including tropospheric O3 here to. You may consult authors of ch7 and 6. [Jan Fuglestvedt, Norway]	Rejected. We do not include tropospheric ozone here since this driver is not further discussed in our chapter.
30754	15	54	16	2	these two sentences could be removed [Annalisa Cherchi, Italy]	Accepted, the sentences have been removed
46912	16	1	16	200	10.1.4.1.1 What about forcing by gaseous short-lived climate forcers such as tropospheric ozone? Do you consider methane short or long-lived? [Laura Gallardo, Chile]	Tropospheric ozone and methane are for now not included in section 10.1.4.1 since they are not assessed in the rest of the chapter.
46914	16	1	16	200	10.1.4.1.2 Are these paragraphs intended to describe the type of phenomena (e.g., Hadley cell expansion) or specific regional impacts (e.g. Sahel). I recommend to choose and approach and use it consistently. In my opinion describing the type of phenomena would be more valueble as a general introduction. [Laura Gallardo, Chile]	Noted. The paragraphs 10.1.4.1.2-4 are intended to describe types of phenomena. At the same time we want to connect with the rest of the chapter by pointing the reader to the sections where regional climate changes that can be attributed to these phenomena are assessed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48922	16	2	16	2	The first time 'GMST' occurs. It is not defined until page 41, line 24. [Chaincy Kuo, United States of America]	Accepted, the acronym has now been defined the first time it is used
46910	16	2	16	2	10.1.4.1.1 Indicate range for long-lived GHG forcing, and indicate X° [Laura Gallardo, Chile]	Accepted; in line with Chapter 7 we use "long-lived GHG" and "well mixed GHG", not applicable, we decided not to give numbers on radiative forcing for the SOD.
46746	16	2	16	16	10.1.4.1.1 Indicate range for long-lived GHG forcing, and indicate X° [Laura Gallardo, Chile]	Accepted; in line with Chapter 7 we use "long-lived GHG" and "well mixed GHG", not applicable, we decided not to give numbers on radiative forcing for the SOD.
46754	16	2	16	16	10.1.4.1.1 What about forcing by gaseous short-lived climate forcers such as tropospheric ozone? Do you consider methane short or long-lived? [Laura Gallardo, Chile]	Tropospheric ozone and methane are for now not included in section 10.1.4.1 since they are not assessed in the rest of the chapter.
46756	16	2	16	16	10.1.4.1.2 Are these paragraphs intended to describe the type of phenomena (e.g., Hadley cell expansion) or specific regional impacts (e.g. Sahel). I recommend to choose and approach and use it consistently. In my opinion describing the type of phenomena would be more valueble as a general introduction. [Laura Gallardo, Chile]	Noted. The paragraphs 10.1.4.1.2-4 are intended to describe types of phenomena. At the same time we want to connect with the rest of the chapter by pointing the reader to the sections where regional climate changes that can be attributed to these phenomena are assessed
42446	16	6	16	7	Over land temperature is highly dependant on soil moisture and increased heating may lead to increased latent and sensible heat fluxes. In energy-limited climates (e.g. cold or tropical climates), where soil moisture is available in sufficient amounts, when surface radiative increases, both latent and sensible heat fluxes are enhanced. In transition regions between wet and dry climates (i.e. water limited areas) when the surface radiative flux rises, the latent heat flux reduces over time, due to a lack of replenishment. However, to keep the surface energy budget, and considering that transport and storage of energy are negligible, an increase of the sensible heat flux ensues, leading higher surface temperatures (Seneviratne et al., 2006, 2010; Miralles et al. 2012) Over deserts, coupling between soil and atmospheres does not exist because of the lack of available water to evaporate, implying that all available energy goes to sensible heating. Seneviratne, S. I., Corti, T., Davin, E. L., Hirschi, M., Jaeger, E. B., Lehner, I., et al. (2010). Investigating soil moisture–climate interactions in a changing climate: A review. Earth-Science Reviews, 99(3), 125-161. https://doi.org/10.1016/j.earscirev.2010.02.004 Seneviratne, S. I., Lüthi, D., Litschi, M., & Schär, C. (2006). Land-atmosphere coupling and climate change in Europe. Nature, 443(7108), 205-209. https://doi.org/10.1038/nature05095 Miralles, D. G., van den Berg, M. V., Teuling, A. J., & de Jeu, R. D. (2012). Soil moisture-temperature coupling: A multiscale observational analysis. Geophysical Research Letters, 39(21), L21707. https://doi.org/10.1029/2012GL053703 [Rita M Cardoso, Portugal]	Noted, but it is not clear what change is actually requested
14078	16	10	16	10	Section 10.4.2.2.1' -> 'Sections 8.2.2.1.2 and 10.4.2.2.1' [Jinwon Kim, Republic of Korea]	Section 8.2.2.1.2 does no longer exist in the advanced draft, and no other suitable section to reference here has been found in Chapter 8.
52276	16	13	16	13	The recent Arctic temperature rise is actually more than twice the GMST. [Sergio Henrique Faria, Spain]	Not applicable, text has been removed.
52260	16	15	16	15	"Phenomenon" instead of "phenomena". [Sergio Henrique Faria, Spain]	Accepted, change made
30756	16	20	16	22	these two sentences could be removed [Annalisa Cherchi, Italy]	Accepted, the two sentences have been removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30762	16	23	16	27	a bit more details on how this regionality of the solar forcing manifest would be a plus [Annalisa Cherchi, Italy]	Taken into account, the text now expands on this.
29520	16	23	16	27	There is a whole bunch of literature demonstrating that the Gray et al. (2013) observation of a lagged solar response in the North Atlantic is related to a modulation/synchronization of the NAO (as one example of internal natural variability mode) with the 11 year solar cycle (e.g., Thieblemont et al., 2015); Thiéblemont, R., K. Matthes, N. Omrani, K. Kodera, and F. Hansen (2015), Solar forcing synchronizes decadal North Atlantic climate variability, Nat. Comm., 6, doi: 10.1038/ncomms9268. There is further evidence that the solar cycle as one external natural forcing driver not only modulates Atlantic internal variability (such as the NAO) but also Pacific decadal modes (e.g., White and Liu, 2008); White, W. B., and Z. Liu (2008), Resonant excitation of the quasi-decadal oscillation by the 11-year signal in the Sun's irradiance, J. Geophys. Res., 113, C01002, doi:10.1029/2006JC004057. Soltje et al. (2018) not only demonstrate the 11-year solar cycle effect on North Atlantic climate, but also investigate the low-frequency part of solar variability - this should be said explitely. I do believe that the selected references do not provide a complete picture of the knowledge about the regional impact of solar variability on climate. A link to the importance for decadal climate predicitions is also missing (e.g., Kushnir et al., 2019); Kushnir, Y., A. A. Scaife, R. Arritt, G. Balsamo, G. Boer, F.Doblas-Reyes, E. Hawkins, M. Kimoto, R. Kumar Kolli, A. Kumar, D. Matei, K. Matthes, W. A. Müller, T. O'Kane, J. Perlwitz, S. Power, M. Raphael, A. Shimpo, D. Smith, M. Tuma, and B. Wu (2019): Towards Operational Predictions of the Near-Term Climate, Nature Climate Change Perspectives. [Katja Matthes, Germany]	Accepted. The suggested literature has been included in the SOD, except for White and Liu, 2008 since the mode that they describe is not cited in the other chapters as having any impact on surface climate.
27282	16	25	16	25	It would be good to also mention other studies finding a rather small or insignificant influence of solar influence on leading modes of variability and more generally, on NH climate. Examples are Schurer et al., 2013 "Small influence of solar variability on climate over the past millennium", and also Ortega et al., 2015 - their reconstructed NAO index does not correlate with solar activity. [Gabriel Chiodo, Switzerland]	Accepted. Ortega et al. 2015 is not referenced.
20914	16	25	16	27	In what way are those impacts identified? What about putting ´, by ....(description)´ behind the sentence? [Gwenaelle GREMION, Canada]	Rejected due to space limitations.
32444	16	32	16	32	Grise et al 2019, J. Clim., 32, 1551-1571 is perhaps also an appropriate reference here. It is a comprehensive analysis of the role of different forcings in CMIP models in the expansion of the tropics. [Isla Simpson, United States of America]	Accepted. Reference included.
53818	16	40	17	20	This subsection on aerosols needs coordination with authors of ch7 to ensure consistency [Jan Fuglestvedt, Norway]	Accepted (well, agreed). We had a short interaction from which we understood that Ch7 treats processes on a global scale while Ch10 on a regional scale. Our aerosol subsection have been substantially improved. However, we were not able to do a deeper coordination with Ch7 because of time and LA limitations.
32124	16	40			I propose to split this section in two : natural aerosols and anthropogenic aerosols as their variability, past and future trends and modelling are very dfferent [Samuel Somot, France]	Accepted. Section has been split in natural aerosols and anthropogenic aerosols.
30758	16	41	16	44	these lines could be removed [Annalisa Cherchi, Italy]	Accepted, the lines have been removed
30760	16	45	16	45	"As they" replaced by "Natural and anthropogenic aerosols" [Annalisa Cherchi, Italy]	Accepted, the change has been made accordingly

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48924	16	45	16	46	Chapter 6 definition of SLCF lifetimes may be up to a few years (900-1000+ days -> few years) for regional influences. See Figure 6.1. [Chaincy Kuo, United States of America]	Noted. This sub-section is only on aerosols, not on all SLCFs. This is why the lifetimes diverges.
32126	16	55			To my knowledge, the decrease in European AOD is maximum over Central and even Eastern Europe. Why do you focus on Western Europe ? (see Nabat et al. 2014 for example, reference already cited in the chap 10) [Samuel Somot, France]	Accepted. This sub-section only mentions some examples and is not exhaustive. The reference has been included in the SOD in sections 10.3 and 10.4.
32128	17	3			what about Mallet et al. 2019 concerning those questions … probably better than Mallet et al. 2016: Mallet, M., Nabat, P., Zuidema, P., Redemann, J., Sayer, A. M., Stengel, M., ... & Meyer, K. (2019). Simulation of the transport, vertical distribution, optical properties and radiative impact of smoke aerosols with the ALADIN regional climate model during the ORACLES-2016 and LASIC experiments. Atmospheric Chemistry and Physics, 19(7), 4963-4990. [Samuel Somot, France]	Rejected. Mallet et al. 2016 is more comprehensive on observations, while the suggested paper treats how to represent the observed Aerosol direct forcing with models.
32446	17	5	17	7	The sentences in this paragraph don't really connect. The first one makes it sound like a comparison is going to be made between tropical and extra-tropical eruptions but then it goes on to talk about the difference between large and small eruptions. [Isla Simpson, United States of America]	Accepted. The volcanic aerosol sub-section has been rewritten for the SOD.
39782	17	5	17	10	The different hydroclimate reponses over global monsoon regions to volcanic aerosol forcing at different ilatitudes (tropical or extratropical) are found in Zuo et al. (2019); An interaction between the volcanic forcing and ENSO has been found in Zuo et al. (2018), they further studied the impact of volcanic eruptions at different hemisphere on ENSO evolution. I suggest adding these two references here. References:Zuo Meng, Tianjun Zhou*, Wenmin Man, 2019: Hydroclimate Responses over Global Monsoon Regions Following Volcanic Eruptions at Different Latitudes.Journal of Climate, 32, 4367-4385. DOI: 10.1175/JCLI-D-18-0707.1; Zuo Meng, Wenmin Man*, Tianjun Zhou, 2018: Different impacts of Northern, Tropical and Southern volcanic eruptions on the tropical Pacific SST in the last millennium. Journal of Climate, 31, 6729-6744, https://doi.org/10.1175/JCLI-D-17-0571.1 [Meng Zuo, China]	Taken into account. The volcanic aerosol sub-section has been rewritten for the SOD but these references have not been because the do not directly address aspects related to regional climate over land.
20916	17	7	17	8	Which interaction? And could you define ENSO for people who do not understand this? [Gwenaelle GREMION, Canada]	Taken into account. The volcanic aerosol sub-section has been rewritten for the SOD. ENSO is not introduced in that subsection any longer.
48926	17	8	17	10	Can there be clarification if the 'extratropical regional impact of tropical volcanic eruptions is emerging' in the literature or verified that it has not existed before? [Chaincy Kuo, United States of America]	Taken into account. The volcanic aerosol sub-section has been rewritten for the SOD and this aspect clarified to illustrate the increasing number of papers that focus on the extratropical impact of the volcanic aerosol load change.
20918	17	9	17	9	Does ´extratropical´ refer to extraordinary for the tropical region? [Gwenaelle GREMION, Canada]	Taken into account, extratropical refers beyond the tropics

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54162	17	10	17	10	At the end of the paragraph, I suggest to add : "Obahoundje et al., (2018) showed that observed changes in land use and land cover (increase in water bodies, built-up, agricultural land and a decline in vegetative areas) over three South Western African basins (Volta, Mono and Sassandra basins) have modified the discharge which varies at least three times much more than the precipitation in the studied basins.". Reference : Obahoundje, S. et al. (2018): Assessment of Spatio-Temporal Changes of Land Use and Land Cover over South-Western African Basins and Their Relations with Variations of Discharges. Hydrology, 5(4), 56. [ARONA DIEDHIOU, Cote d'Ivoire]	Rejected. This is an introductory section that aims at describing different phenomena that impact on regional climate change. It is not a section that go into detail describing particular regional climate changes.
30764	17	12	17	20	a link to appropriate section in ch 8 should be added [Annalisa Cherchi, Italy]	Accepted, a link to Chapter 8 has been included.
41056	17	23	19	17	should add the content about Anthropogenic Heat Release(AHR) on regional climate, although IPCC AR5 did not include AHR. My comments: Anthropogenic heat is a direct, external energy source to the Earth-atmosphere system impacting the energy balance of the Earth's surface as a result of global energy consumption (Chen et al., 2019). It is an important factor for urban heat island and urban climate (IPCC, 2007). The global mean flux of AHR is 0.03 W m-2, while it is geographically concentrated and fundamentally correlates with economic activity (Chen et al., 2014). AHR increases the sensible heat flux near the surface (Zhang et al., 2013), increase the surface temperature (Feng et al., 2012; Chen et al., 2014; Chen et al., 2019), strengthens the turbulence and enhances mixing and turbulent energy transport, lifts planetary boundary layer height (Nie et al., 2017; Chen et al., 2019), and it is important for regional weather (Nie et al., 2017). With the rapid development of global urbanization, the effect of AHR on urban regional climate will be enhanced (Chen et al., 2014). It can reach high enough level to impact regional climate (Feng et al., 2012; Bohnenstengel et al., 2014; Nie et al., 2017), even global climate (Zhang et al., 2013; Chen et al., 2014; Chen et al., 2019). AHR affect the stability of the lower troposphere, and impact regional and global atmospheric circulation further (Zhang et al., 2013; Chen et al., 2019).The modeling research show that AHR can increase the surface temperature in the mid- and high latitudes over North Hemisphere in the boreal winter (Zhang et al., 2013; Chen et al., 2016; Chen et al., 2019), which is probably a missing forcing for the additional winter warming trends in observations (Zhang et al., 2013). Reference Bohnenstengel S. I., Hamilton I., Davies M., Belcher S.E., 2014: Impact of anthropogenic heat emissions on London's temperatures, Q. J. R. Meteorol. Soc. 140: 687–698, doi:10.1002/qj.2144 Chen B., Dong Li, Liu X., Chen L, Nakajima T., Habib A., 2016: Exploring the Global Climatic Effect of Anthropogenic Heat Release: A Global Climate Model Study, Int. J. Climatol., 36, 4790–4796, doi: 10.1002/joc.4669.	Accepted. The issue of anthropogenic heat release is now assessed in the new urban box in the SOD.
32130	17	23			Concerning urbanisation, did you assess Daniel et al. 2019 : Daniel M., Lemonsu A., Déqué M., Somot S., Alias A., Masson V (2019) Benefits of explicit urban parametrization in regional climate modelling to study climate and city interactions. Climate Dynamics, 52(50),2745-2764, doi:10.1007/s00382-018-4289-x http://link.springer.com/article/10.1007/s00382-018-4289-x [Samuel Somot, France]	Accepted, reference added in the SOD
6241	17	29	17	29	Anthropogenic land use and land use changes [Mostafa Jafari, Iran]	Noted, but it is not clear what revision is suggested.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6243	17	29	17	29	General: changes in natural ecosystems such as forest ecosystems should be quated separately [Mostafa Jafari, Iran]	Rejected. It is considered that the current formulation fills the purpose of the section which is to describe how changes in land use and management including urbanization affect regional climate.
42448	17	30	17	31	Although the impact of land-use changes is associated to large uncertainties, the LUCID intercomparison study indicates that land-use changes, in some regions, can have a similar impact as GHG (de Noblet-Ducoudre et al. 2012). They are particularlly relevant for regional climate trends and extreme temperatures (Lejeune et al. 2017, 2018; Kumar et al. 2013) de Noblet-Ducoudre, N., and Coauthors, 2012: Determining Robust Impacts of Land-Use-Induced Land Cover Changes on Surface Climate over North America and Eurasia: Results from the First Set of LUCID Experiments. J. Clim., 25, 3261–3281, doi:10.1175/JCLI-D-11-00338.1. Lejeune, S. I. Seneviratne, and E. L. Davin, 2017: Historical land-cover change impacts on climate: Comparative assessment of LUCID and CMIP5 multimodel experiments. J. Clim., 30, doi:10.1175/JCLI-D-16-0213.1. Lejeune, Q., E. L. Davin, L. Gudmundsson, J. Winckler, and S. I. Seneviratne, 2018: Historical deforestation locally increased the intensity of hot days in northern mid-latitudes. Nat. Clim. Chang., 8, 386–390, doi:10.1038/s41558-018-0131-z. http://www.nature.com/articles/s41558-018-0131-z Kumar, S., P. A. Dirmeyer, V. Merwade, T. DelSole, J. M. Adams, and D. Niyogi, 2013: Land use/cover change impacts in CMIP5 climate simulations: A new methodology and 21st century challenges. J. Geophys. Res. Atmos., 118, 6337–6353, doi:10.1002/jgrd.50463. http://doi.wiley.com/10.1002/jgrd.50463 [Rita M Cardoso, Portugal]	Noted; these references have been used for the SRCCL, which is referred to here (Box 10.1).
29668	17	31	17	34	To avoid possible confusion, it would be better to insert here the phrase, "It is unlikely, however, that regional biophysical climate impact of afforestation may override its global biogeochemical climate impact (Grassi et al., 2019)" (Grassi, G., Cescatti, A., Matthews, R., Duveiller, G., Camia, A., Federici, S., House, J., de Noblet-Ducoudré, N., Pilli, R. and Vizzarri, M., 2019. On the realistic contribution of European forests to reach climate objectives. Carbon Balance and Management, 14: 8. ttps://doi.org/10.1186/s13021-019-0123-y) [Georgii Alexandrov, Russian Federation]	Rejected. Due to space restrictions we here only give an example of differential impacts afforestation can have in different regional climates. We can not include global impacts.
42450	17	34	17	34	In summer and autumn, the influence of afforestation is associated to large uncertainties associated to the soil moisture and the sensible and latent heat balance (Davin et al. 2019). Davin EL, Rechid D, Breil M, Cardoso RM, Coppola E, Hoffmann P, Jach LL, Katragkou E, de Noblet-Ducoudré N, Radtke K, Raffa M, Soares PMM, Sofiadis G, Strada S, Strandberg G, Tölle MH, Warrach-Sagi K, Wulfmeyer V (2019) Biogeophysical impacts of forestation in Europe: First results from the LUCAS Regional Climate Model intercomparison, Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2019-4 [Rita M Cardoso, Portugal]	Rejected. Due to space limits and the scope of this introduction we can only mention the fact that different land-use actions (afforestation is the example) implicates different climate response in different background climate. We cannot go into detail to discuss seasonal uncertainties over Europe.
52268	17	36	17	36	The word "Section" is missing within the brackets. [Sergio Henrique Faria, Spain]	Accepted, "Section" has been added
46916	17	38	17	39	10.1.4.1.5 The statment must by qualified by spatial scale…Urbanization might have a null global impact but regionally it can be severe [Laura Gallardo, Chile]	Taken into account, the text modified in the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
58014	17	38	17	39	Huszar, P., Halenka, T., Belda, M., Zak, M., Sindelarova, K., and Miksovsky, J., (2014): Regional climate model assessment of the urban land-surface forcing over central Europe. Atmos. Chem. Phys., 14, 12393-12413. [Tomas Halenka, Czech Republic]	Taken into account. This reference is about the benefit of using an urban canopy model within RegCM4 for four years of simulation and is now included in the urban box about the different urban downscaling methods that is planned for the SOD.
30766	17	43	17	43	northern Belgium close to Flanders should be added [Annalisa Cherchi, Italy]	Accepted, Northern Belgium has been added to the text.
43412	17	43	17	45	Highly confusing sentence. [Saad Amer, United States of America]	Accepted, text changed
56046	17	50	17	53	Intrinsically coupled mode of climate variability should be mentioned here. [Corti Susanna, Italy]	Accepted.
46918	17	50	17	55	10.1.4.2 Repetition? [Laura Gallardo, Chile]	Accepted. The text has been shortened. Some overlap is required for the Chapter to be self-contained though.
46950	17	50	17	55	10.1.4.2 Repetition? [Laura Gallardo, Chile]	Accepted. The text has been shortened. Some overlap is required for the Chapter to be self-contained though.
46264	17	50	17	55	In this section, it should be noted that human behavior also affects climate change (through harmful activities, the destruction of wetlands, etc.) [sadegh zeyaeyan, Iran]	taken into account – land use change is discussed in 10.1.4.1.7
8898	17	50	17	55	In this section, it should be noted that human behavior also affects climate change (through harmful activities, the destruction of wetlands, etc.) [Mohammad Javad Zareian, Iran]	taken into account – land use change is discussed in 10.1.4.1.7
57540	17	50	17	55	In this section, it should be noted that human behavior also affects climate change (through harmful activities, the destruction of wetlands, etc.) [Sahar Tajbakhsh Mosalman, Iran]	taken into account – land use change is discussed in 10.1.4.1.7
52272	17	54	17	54	"This chapter" instead of "the chapter". [Sergio Henrique Faria, Spain]	Not applicable – text has been rewritten.
46920	18	1	18	200	10.1.4.2 No explicit reference for the Pacific Decdal Oscillation? Given its relevance, it should be better represented. [Laura Gallardo, Chile]	Accepted, text revised
46922	18	1	18	200	10.1.4.3 A diagram illustrating teleconnections might be of help for non-expert readers. Perhaps this figure can be found elsewhere in the report, in that case refer to it. [Laura Gallardo, Chile]	Taken into account. Such a diagram is included in Annex VI
46952	18	1	18	200	10.1.4.3 A diagram illustrating teleconnections might be of help for non-expert readers. Perhaps this figure can be found elsewhere in the report, in that case refer to it. [Laura Gallardo, Chile]	Taken into account. Such a diagram is included in Annex VI
46758	18	2	18	18	10.1.4.2 No explicit reference for the Pacific Decdal Oscillation? Given its relevance, it should be better represented. [Laura Gallardo, Chile]	Accepted, text revised
46760	18	2	18	18	10.1.4.3 A diagram illustrating teleconnections might be of help for non-expert readers. Perhaps this figure can be found elsewhere in the report, in that case refer to it. [Laura Gallardo, Chile]	Taken into account. Such a diagram is included in Annex VI
32448	18	4	18	4	I would say that mid-latitude jet is a more common way to refer to the tropospheric extra-tropical westerlies. The jet speed maximizes in the mid-latitudes, so I think it would be more appropriate to refer to it as the mid-latitude jet. [Isla Simpson, United States of America]	Accepted, text revised
14080	18	10	18	10	Between 'Dong et al, 2013).' and 'For instance', add: 'A relationship between NAP and spring temperature and snowmelt in the upper southwestern United States has also been found (Myung et al. 2017).' [Jinwon Kim, Republic of Korea]	Rejected. It is not clear what NAP is. Besides, the chapter tries to avoid describing very regional features

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
6800	18	11	18	15	It has been shown that there is a considerable non-stationary behaviour in the temporal correlations between the NAO and surface temperature and precipitation over Europe due to the non-stationary and non-linear variability of the NAO (Hertig et al. 2015). Reference: Hertig, E., Beck, Ch., Wanner, H., Jacobeit, J. (2015): A review of non-stationarities in climate variability of the last century with focus on the North Atlantic-European sector. Earth Science Reviews 147, 1-17. [Elke Hertig, Germany]	Accepted. Text revised.
39640	18	11	18	43	These paragraphs describe some of the regional impacts associated with the large-scale modes of variability but is certainly not comprehensive. On the other hand if it is an introduction to the topic, it is too detailed. Therefore the purpose of these paragraphs should be better determined. [Carolina Vera, Argentina]	Taken into account – the text has been shortened with references to Chapters 2, 3, 4 and 9.
32450	18	14	18	14	I think that some of the original papers on this topic should be cited e.g., Hurrell (1995), Science, 269, 676-679, Hurrell and van Loon 1997, Climatic Change, 36, 301-326. [Isla Simpson, United States of America]	Rejected – the list is just illustrative, not comprehensive. We don't have space to give both recent and classic literature.
42452	18	14	18	15	Add references(Sánchez-López et al., 2016; Trigo et al. 2002, 2004) Sánchez-López G, Hernández A, Pla-Rabes S, Trigo RM, Toro M, Granados I, Sáez A, Pueyo JJ, Rubio-Inglés MJ, Giralt S. (2016) Climate reconstruction for the last two millennia in central Iberia: The role of East Atlantic (EA), North Atlantic Oscillation (NAO) and their interplay over the Iberian Peninsula. Quaternary Science Reviews 149, 135 -150. Doi: 10.1016/j.quascirev.2016.07.021 Trigo R.M., Pozo-Vazquez D., Osborn T.J, Castro-Diez Y., Gámis-Fortis S., Esteban-Parra M.J. (2004) North Atlantic Oscillation influence on precipitation, river flow and water resources in the Iberian Peninsula. Int J of Climatology. 24, 925-944 Trigo R.M., Osborn T.J., Corte-Real J.M. (2002) The North Atlantic Oscillation influence on Europe: climate impacts and associated physical mechanisms. Climate Research, 20, 9-17 [Rita M Cardoso, Portugal]	Rejected – we cannot afford a comprehensive list for space reasons. The cited literature is already sufficient.
30768	18	14	18	18	there is more recent literature about SNAO [Annalisa Cherchi, Italy]	Rejected – the list is just illustrative, not comprehensive.
50996	18	15	18	15	Not clear what you mean by "for instance": the two sentences have not much in common (the sentence before talks about summer NAO, the sentence after about SAM) [Bart Van den Hurk, Netherlands]	Not applicable – text has been rewritten.
32452	18	17	18	17	Similar to above, I think there are more original papers that discuss the natural origins of SAM variability e.g. Thompson and Wallace 2000, Lorenz and Hartmann 2000. [Isla Simpson, United States of America]	Rejected – the list is just illustrative, not comprehensive. We don't have space to give both recent and classic literature.
56048	18	20	18	20	long time scales iinstead of large time scales [Corti Susanna, Italy]	Accepted, text revised
32454	18	25	18	26	No references are provided for the statement that the AMV can influence European temperatures and I think there should be some. Also, Yamamoto and Palter (2015), Nature Communications, 7, 10930 argue that it doesn't have an influence during the wintertime. But there are many studies that argue for a summertime influence e.g., Qasmi et al 2017, GRL, 44, 11140-11149 and references therin. [Isla Simpson, United States of America]	Not applicable – text has been shortened.
41350	18	26	18	32	Several very technical terms eg diabatic heating, baroclinic, streamfunction dipole [Debra Roberts, South Africa]	Accepted, text has been revised.
32456	18	28	18	28	"central to eastern" what? Needs clarification. [Isla Simpson, United States of America]	Not applicable – text has been shortened.
50998	18	28	18	29	NH Winter or SH winter? [Bart Van den Hurk, Netherlands]	Not applicable – text has been shortened.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20920	18	41	18	41	I would suggest it is better to use "contributions to" instead of "impact on" here; since the modes and teleconnections drive the regional climates. [Gwenaelle GREMION, Canada]	rejected– also the term impact describes the issue raised by the reviewer
32132	18	46			I don't understand why the regional phenomena which are « objects of study » are in the section concerning the source of variability. I would put them at the same level as the « regional climate messaages ». Studying the regional phenomena is key goal of the regional climate studies, not only part of the variability. I don't think it fits in section 10.1.4 [Samuel Somot, France]	Accepted; this sub-sub-section deals with "local phenomena and feedbacks" referring to those phenomena that act at a scale smaller than the region under consideration; the part on ice sheets has been removed and a better link to section 10.3 made for the SOD
32134	18	48			I would add more regional phenomena over the sea such as the regional winds (and the associated strong air-sea fluxes) or the ocean deep convection or the quasi-stable eddies. [Samuel Somot, France]	Taken into account; although the emphasis of the chapter is on climate over land, the ocean plays an important role as a driver. However, the phenomena mentioned by the reviewer are considered in Chapter 9 in the SOD
52274	18	51	18	51	"Oases" instead of "oasis". [Sergio Henrique Faria, Spain]	Accepted, text changed
41348	18				Up until this point the chapter was accessible and easy to read due to the infrequent use of acronyms. Suddenly this changed, this page is littered with new acronyms, which make it significantly more difficult to read. Please use acronyms only for frequent terms used throughout the report and therefore easy to remember. [Debra Roberts, South Africa]	Taken into account, acronyms are used less profusely in the SOD
7678	19	1	19	5	the small paragraph mentions only regional climate and orography. Sentences could be added regarding the type of soils and their influence on the soil moisture and feedback associated. [isabelle gouirand, Barbados]	Accepted. The sub-section was rewritten in the SOD, although the type of soils were not mentioned as such, but rather a reference was made to the relevance of the land use.
41352	19	3			Orography: consider using another term, like geography or topography or mountain relief – something that is generally understood [Debra Roberts, South Africa]	Accepted, text changed
46924	19	6	19	7	10.1.4.2 Aerosols affect temperature and other variables, temperature in particular…. [Laura Gallardo, Chile]	Not applicable - text has been deleted
51000	19	7	19	7	positive stratification, I assume? [Bart Van den Hurk, Netherlands]	Accepted, text changed
51002	19	9	19	9	What does this 10% mean? [Bart Van den Hurk, Netherlands]	Accepted, text changed to "of the total particles amount"
41354	19	13			Please explain advection and downward short wave in a way that is understandable by non-specialists. [Debra Roberts, South Africa]	Rejected, we need to avoid the chapter to read as a text book
32138	19	18			I would add the air-sea regional feedbacks (see for example Somot et al. 2008, Nabat et al. 2015 but much more). Both ref are already cited in chap 10 [Samuel Somot, France]	Taken into account; although the emphasis of the chapter is on climate over land, the ocean plays an important role as a driver. However, the phenomena mentioned by the reviewer are considered in Chapter 9 in the SOD
38122	19	22	21	4	conclusions in SRCCL, SROCC, SR15, AR5 are cited one by one and some contents are duplicate/verbose. It would be better to re-orgnize these conclusions in a way consistent with AR6 context, for example: simple say what changes in atmopshere and/or what's clonclusion (that are reported in one or some Special Reports), then followed by changes in oceans, snow/ice, land/use, vegetation and so on. In orther word, it is better to cite in the order of climate system components, instead of the order of Special Reports. [Daoyi Gong, China]	Rejected, we decided to do it this way for the reader to easily identify the sources and the evolution of the treatment of regional information, in spite of the duplication. In any case, the box has been rewritten for the SOD for better readability

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54552	19	24	19	26	Should include Chapter 21 of AR5 WG2 as well here. [Linda Mearns, United States of America]	Accepted, this chapter is now included in the box
20922	19	28	19	28	Which gaps need to be addressed? Would it be good to clarify this more? [Gwenaelle GREMION, Canada]	Taken into account. The gaps are the treatment of regional climate change and the processes that convert climate information into regional climate messages
30770	19	34	19	34	chapter 9 or chapter 14 as mentioned in the lines above? [Annalisa Cherchi, Italy]	Accepted, text changed
30772	20	3	20	3	remove "in particular" [Annalisa Cherchi, Italy]	Accepted, text changed
48822	20	13			“Urbanization” is a process not a characteristic itself . Please consider: “impervious soils also increase…” [António Lopes, Portugal]	Taken into account
52426	21	9	23	54	It is a good idea to have a cross-chapter box on the the influence of the Arctic on mid-latitude climate: It is a strongly debated and rapidly developing research field , with several new papers published every month. This has also created a lot of misunderstandings (in the larger climate science community and outside) and it would be great if with the IPCC report some clarity is created. However, the box in its current form is not helpful in that respect and rather creates more confusion. The underlying reason is that none of the authors of this cross-chapter box (while all high-level and well respected scientists) have actively published in this particular field over the last years. This has resulted in a text that mixes up and misrepresents different theories, and also it does not provide a proper balance between evidence and counter-evidence for the different theories. Also only a fraction of the relevant literature is cited and it is especially problematic that the most recent literature - that has reconciled some constroversies - is largely lacking. Below I provide some specific comments. In its current form the box is not acceptable and in my view it has to be mostly rewritten. I encourage the authors to involve one or more scientists that are actively publishing in this specific field, and to write a box that clearly explains the different dynamical mechanisms plus a fair assessment on the balance of evidence. [Dim Coumou, Netherlands]	Taken into account. Box has been rewritten
16066	21	38	21	38	"planned" should read "expected" or "projected". [SAI MING LEE, China]	Not applicable: box rewritten
32458	21	38	21	38	I don’t think “planned” is the right way of doing it. It’s not like we planned for this to happen. “expected” is probably more appropriate. [Isla Simpson, United States of America]	Not applicable: box rewritten
32460	22	1	22	55	I don’t really think the way this box is structured is the most effective. I think it would be most appropriate to discuss the disagreement about the effects up front as they are described. For example, Francis and Vavrus (2012) is cited in the “jet stream fluctuations” but I think Barnes (2013) pretty convincingly demonstrated that their methodology was flawed. Also, Hassanzadeh et al (2014), GRL, 14, 5223-5232 argue that the wave amplitude and blocking should reduce whn the meridional temperature gradient is reduced. We don’t learn about that disagreement until much further down the box, and I think that should be mentioned up front. The Hassanzadeh paper isn’t cited and probably should be. [Isla Simpson, United States of America]	Taken into account: The disagreement is mentioned now upfront, although we remain with the set-up of first discussing the proposed theories and in the next phase discussing the critics.
52430	22	3	22	13	Here diferent mechanisms are mixed up. One is weaker jets and the other is waveguide effects that might amplify quasi-stationary waves [Dim Coumou, Netherlands]	Taken into account: The box has been rewritten

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
52428	22	4	22	36	The division into 'jet stream fluctuations', 'storm tracks' and 'polar vortex outbreaks' is not practical, leading to different mechanisms being mixed up (see comments below). It is way better to divide into winter and summer dynamics, and possible Arctic links. [Dim Coumou, Netherlands]	Accepted: The box has been rewritten with the division between winter and summer dynamics.
30010	22	5	22	13	You should distinguish between winter and summer, as the theories are necessarily quite different in the two seasons. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: The box has been rewritten with the division between winter and summer dynamics.
52278	22	11	22	11	Replace "will" by "would". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
13932	22	11	22	11	I would suggest '…. meandering flow may increase the likelihood…'. (since these theories also involve a weakening of the meridional temperature gradient). [Tim Woollings, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: box rewritten
52432	22	15	22	25	Again different mechanisms are being mixed up. Storm track changes (i.e. weakening) are important in summer (e.g. Chang et al, GRL, 2016; Coumou et al, Science 2015) while the Warm-Arctic Cold-Continent (WACC) pattern is a winter phenomenon, which is also not related to storm tracks changes but to trends in the stratospheric polar vortex (eg. Cohen et al, Nat Geo, 2014). [Dim Coumou, Netherlands]	Accepted, the box is being completely rewritten for the SOD following the suggestions in this and other comments
52280	22	20	22	20	Replace "recent" by "recently". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
32462	22	22	22	25	I think Sun et al (2016), GRL, 43, 5345-5352 argue that the observed warm-arctic-cold-continent is not due to sea ice loss but rather is due to internal variability. I think some discussion of these conflicting views should be provided. [Isla Simpson, United States of America]	Accepted; these conflicting are now discussed more in detail in the SOD
39066	22	27	22	36	I don't think "polar vortex outbreaks" is a commonly used term. It sounds like a mix between "vortex breakdowns" and "cold air outbreaks". Suggest changing this to "polar vortex variability" or "polar vortex breakdowns" [Isla Simpson, United States of America]	Not applicable: box rewritten
30006	22	29	22	31	A recent reference for this point is Kretschmer et al. (2018 BAMS doi: 10.1175/BAMS-D-16-0259.1). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the reference is included in the SOD
52434	22	31	22	32	"Arctic warming has been linked to an increase of those stratospheric "outbreaks" (Kim et al., 2014)": Sentence is much overconfident. Rather the WACC pattern has been linked to stratospheric variability. [Dim Coumou, Netherlands]	Taken into account: WACC has now been linked to stratospheric variability
52282	22	32	22	32	Replace "mechanism point" by "mechanisms points". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
30008	22	32	22	36	This does not seem like a balanced treatment of the literature. The evidence seems to point much more to Barents-Kara sea ice loss than to declining snow cover (Kretschmer et al. 2016 J.Clim. doi:10.1175/JCLI-D-15-0654.1). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: It is now discussed in relation to Barents-Kara sea ice loss.
16068	22	34	22	34	"Artic" should read "Arctic". [SAI MING LEE, China]	Not applicable: box rewritten
52436	22	34	22	36	There is no strong evidence for the role of snow cover in autumn on winter circulation. There is certainly more evidence that sea-ice in autumn in Barents-Kara seas is an important factor (but not via snowcover). [Dim Coumou, Netherlands]	Accepted. The role of snow cover is removed and the Barents-Kara sea more discussed
32464	22	40	22	40	A paper that hasn't been cited in this box is Hoskins and Woollings (2015), Curr Clim Change Rep, 1, 115-124. This provides a review of the theory of the various concepts discussed and, from what I recall, argues that it is not so clear that the proposed theories are entirely well rooted in proven concepts of theoretical fluid dynamics. This paper and references within may be useful in refining some of this discussion. [Isla Simpson, United States of America]	Accepted: Hoskins and Woollings is now discussed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
52284	22	45	22	45	Replace "triggers" by "trigger". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
52438	22	47	22	50	The statements about (lagged) correlation analyses are correct of course, but misses recent literature that applied causal inference techniques (e.g. Kretschmer et al, J Clim, 2016). [Dim Coumou, Netherlands]	Accepted: The applied causal reference technique of Kretschmer et al. (2016) is now discussed.
48928	22	48	22	48	The word 'also' is repetitive, after 'In addition,' [Chaincy Kuo, United States of America]	Not applicable: box rewritten
52286	22	48	22	48	"Even" alone cannot be used as a conjunction. It needs a complement, e.g. "even if/when/though". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
32466	22	48	22	48	Should this be “even IF significant”? That changes the meaning quite a bit, [Isla Simpson, United States of America]	Not applicable: box rewritten
51004	22	50	22	50	"…which is not always accounted for in statistical tests.": move this phrase to the previous sentence, and leave the sentence on sea-ice concentration without this statement [Bart Van den Hurk, Netherlands]	Not applicable: box rewritten
52288	22	54	22	54	Hyphen missing in "clear-cut". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
16070	23	3	23	3	"Artic" should read "Arctic". [SAI MING LEE, China]	Not applicable: box rewritten
30012	23	5	23	10	You could connect these two sentences. Kretschmer et al. (2016 J.Clim. doi:10.1175/JCLI-D-15-0654.1) does attempt to disentangle cause and effect through their methodology, and find no evidence of the impact of Eurasian snow cover (though do of Barents-Kara sea ice loss; this should surely be mentioned here). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: Kretschmer et al. (2016) is now discussed and their findings with respect to the Barents-Kara sea ice loss and snow cover
52440	23	15	23	17	"Recently, new studies have emerged that reconcile in a coherent way observations and models (Mori et al., 2019) and enable to separate the different forcings (McCusker et al., 2017; Zappa et al.,2018)". Indeed, and the outcomes of those recent studies are very insightful and can reconcile the problems raised in the section above. These papers, together with other recent work that overcomes some controversies, should be discussed as they present the state of the art [Dim Coumou, Netherlands]	Accepted, the box is being completely rewritten for the SOD following the suggestions in this and other comments
13934	23	16	23	16	Note that a comment has been submitted on the Mori et al paper questioning the causality, along the lines of the discussion on the previous page. [Tim Woollings, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, the box is being completely rewritten for the SOD following the suggestions in this and other comments
30774	23	21	23	21	remove "To note a few:" [Annalisa Cherchi, Italy]	Not applicable: box rewritten
56050	23	21	23	21	PDO I believe that in most of the report is referred as PDV [Corti Susanna, Italy]	Accepted, text changed
30776	23	23	23	23	add "are some examples" after the parenthesis [Annalisa Cherchi, Italy]	Not applicable: box rewritten
16072	23	25	23	26	"Artic" should read "Arctic". [SAI MING LEE, China]	Not applicable: box rewritten
13936	23	26	23	26	This sentence didn't make sense to me [Tim Woollings, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: box rewritten
30778	23	28	23	28	"coupling" with what? [Annalisa Cherchi, Italy]	Not applicable: box rewritten
52442	23	29	23	30	Increasing storm track activity does not necessary lead to reduced blocking frequency (and vice versa). Blocking often occurs directly downstream of a strong storm track, especially in winter [Dim Coumou, Netherlands]	Accepted: The relation between storm track activity and blocking has been removed.
52290	23	37	23	37	Delete extra "be". [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
16074	23	37	23	37	"Artic" should read "Arctic". [SAI MING LEE, China]	Not applicable: box rewritten
32468	23	39	23	39	should this be “poleward heat transport”? Is it actually “heat anomalies” that are being transported or can the anomalous circulation act on the mean temperature gradients to transport heat poleward. If the latter is true, then I think it should be “poleward heat transport” [Isla Simpson, United States of America]	Not applicable: paragraph has been removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
13938	23	40	23	40	Other theories by which mid-latitude waves can affect the Arctic warming are given by Woods and Caballero (https://doi.org/10.1175/JCLI-D-15-0773.1) and Lee (https://doi.org/10.1007/s13143-014-0024-7). [Tim Woollings, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. The results of Woods and Caballero and Lee are discussed
52292	23	42	23	42	Punctuation: commas are missing. [Sergio Henrique Faria, Spain]	Not applicable: box rewritten
52444	23	42	23	44	Reduce cold extremes in winter, yes, but not enhance warm extremes in summer. Warm extremes in summer are not (!) "due to advection of warmer air from the Arctic into the midlatitudes" [Dim Coumou, Netherlands]	Accepted: summer effect is removed from text
32470	23	44	23	44	Another relevant paper here is Schneider et al (2015), J. Clim., 28, 2312-2332 [Isla Simpson, United States of America]	Taken into account. The results of Schneider are discussed
52448	23	46	23	46	High-confidence that the Arctic can influence: This is an empty phrase. In any complex connected system, any perturbation in some part of the system will have a non-zero effect elsewhere. The question is whether it is an important effect as compared to overall variability. And in the latter we do not have high confidence [Dim Coumou, Netherlands]	Accepted: The first confidence statement has been removed. The assessment has been rewritten
52446	23	46	23	48	This statement should at least be split between warm and cold season [Dim Coumou, Netherlands]	Accepted. The warm and cold season are now treated separately.
52450	23	47	23	48	I probably agree that we have low confidence in the exact role, but the supporting statement: 'The signal is small compared to internal variability' is wrong. We do not know that, and it certainly depends on season and region [Dim Coumou, Netherlands]	Not applicable: box rewritten
54098	23	55	23	55	In this part of chapter (10.1), several challenges have been addressed for providing regional information messages based (e.g. P13 line 23-25; P15 lines 12-14; P14 Line 38-44). It is highly suggested that a subtitle be added at the end of this part to summarize the challenges raised throughout (e.g. for 10.1). The idea can be extended to other parts of the chapter. [Husain Najafi, Iran]	Taken into account
46926	24	1	24	200	10.2.1.1 Discuss hemispheric and otherwise asymmetry in coverage of in situ and remote observations. Is there a minimum set of observations required for model evaluation ? [Laura Gallardo, Chile]	Taken into account. Text added for the SOD.
45520	24	1	31	1	I find that the section on observations is too descriptive (textbook style) and provides little insight on the specificities and issues with observations for climate at regional scales. For example, include some discussion about how the observational uncertainty depends on the spatial scale. I think most of this section could go in an appendix [Di Luca Alejandro, Australia]	Taken into account. Text modified for the SOD.
46762	24	2	24	24	10.2.1.1 Discuss hemispheric and otherwise asymmetry in coverage of in situ and remote observations. Is there a minimum set of observations required for model evaluation ? [Laura Gallardo, Chile]	duplication of 46926
7680	24	7	24	7	the term "High quality" should be clarified as it is not clear what the term is refering too (time resolution, space scale or quality of measurement..) [isabelle gouirand, Barbados]	Taken into account. High-quality is replaced by quality controlled
7682	24	7	24	10	the paragraph could integrate a few sentences about spatial and temporal resolution of the data. Data scarcity mentioned later and temporal resolution (lack of daily data available for a long period) are limitating factors in climate and trend analysis of wet/dry spell or hot/cold days for example. [isabelle gouirand, Barbados]	Taken into account. Text has been modified for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54100	24	7	24	11	An introduction to open the section 10.2 is not targeted. It lacks the relevant relation to the objective of chapter and its link to the other parts. It is suggested that a general sentence be added the first paragraph of section 10.2 which shows the importance of observations in producing regional messages as an indispensable component, especially for interpretation of climate model simulation (section 10.3). [Husain Najafi, Iran]	Taken into account. Text will be modified for the FGD and a new paragraph introducing the content of the section will be added.
20924	24	24	24	24	Is the word ´also´ needed here? [Gwenaelle GREMION, Canada]	Editorial. Also is removed.
20926	24	24	24	24	I would suggest to replace "surface" with "direct". The radiosondes in fact collect data up to the stratosphere, whereas radars can be located both on the Earth`s surface and onboard sattelites [Gwenaelle GREMION, Canada]	Accepted. Surface is replaced by direct.
20928	24	25	24	25	In addition to the space-borne, radar, and lidar systems/techniques, I would recommend adding "reflectometry, occultation" which are having a huge impact as the remote sensing systems. [Gwenaelle GREMION, Canada]	Accepted. reflectometry, occultation is included in the list.
13964	24	32	24	34	"weaknesses (McPherson, 2013). Supersite observatories are surface observing networks that measure a large amount of atmospheric and soil variables at least hourly over a decade or more (Ackerman and Stokes, 2003; Chiriaco et al., 2018; Haeffelin et al., 2005; Su et al., 2018; Xie et al., 2010). With adequate calibration, quality control and " [Jun Wen, China]	Rejected. Complete information about the suggested reference Su et al. 2018 to be added is missing.
54074	24	38	24	39	A significant new dataset is the Global sub-daily rainfall (GSDR) dataset by Lewis et al. (2019) which is providing new capacity to assess global and regional changes in intense rainfall Lewis, E., H. Fowler, L. Alexander, R. Dunn, F. McClean, R. Barbero, S. Guerreiro, X. Li, and S. Blenkinsop, 2019. GSDR: A global sub-daily rainfall dataset. J. Climate, https://doi.org/10.1175/JCLI-D-18-0143.1 [Stephen Blenkinsop, United Kingdom (of Great Britain and Northern Ireland)]	Accepted (The reference is added).
54104	24	39	24	40	You can add the other products with relevant citations (e.g. APHRODITE, GPCC v7, and CRU data sets). Consider that (Ashouri et al., 2015) is not directly based on in situ data, it is based on stations used in GPCP in monthly time scale. You can consider CHIPRS dataset here. [Husain Najafi, Iran]	Accepted (Ashouri et al., 2015 is replaced with Funk et al., 2015)
42456	24	39	24	40	Missing reference for daily datasets Tank et al. 2002 Klein Tank, A.M.G. and Coauthors, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. Int. J. Climatol., 22, 1441-1453. [Rita M Cardoso, Portugal]	Rejected - The reference for daily datasets Tank et al. 2002 is older than 2013, updated reference is cited.
54106	24	43	24	55	It is suggested to cite other products as well (e.g. CHIRP, CMORPH, PERSIANN, PERSIAN-CDR, PERSIANN-CCS). [Husain Najafi, Iran]	Taken into account (The text is edited).
32472	24	48	24	48	“has a full converage of the globe as long as 8-16 days” is pretty unclear. It sounds like it means there are 8-16 days of coverage total. Is the following really what is meant? “obtained full coverage of the globe once every 8 to 16 days” [Isla Simpson, United States of America]	Accepted. Text has been revised accordingly.
43414	24	55			Satellite [Saad Amer, United States of America]	Editorial

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8142	24		25		It should be included that biogeochemical processes and particularly productivity changes in the ocean can be investigated in using remote sensing techniques. Chlorophyll concentration distribution and dynamics in the surface oceans can be recorded over long timescales. This can be used to study the feedback of phytoplankton dynamics and related productivity changes to CO2 concentrations in the surface water and the atmosphere, thereby helping to see the role of marine biology to regional and global climate. [Sebastian Naeher, New Zealand]	Rejected. It has been decided not to include ocean observations in this chapter for the purpose of minimizing repetition with chapter 9. More information can also be found in the recent special report SROCC.
13966	25	2	25	3	"2018), Meteosat-10 and 11 (Schmetz et al., 2002), Himawari-8 and 9 (Kurihara et al., 2016) and Funyun-4 (Yang et al., 2017) are valuable for regional applications since they provide images at very high spatiotemporal resolution, typically 1–2 km, " [Jun Wen, China]	Accepted. China's gestational satellite FY-4 has the same performance with other satellite introduced here. We add FY-4.
48292	25	6	25	12	Relevant information from the GCOS Essential Climate Variables (ECVs), e.g. those from the European Space Agency Climate Change Initiative and the European Union,s Copernicus Climate Change Service, should be included here. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Following to this comments, we insert one phrase explaining the GCOS / ECVs / Copernicus.
48930	25	11	25	11	"synchronous" is mispelled [Chaincy Kuo, United States of America]	Accepted
44176	25	11	25	11	Typo: synchronous [Ramiro Saurral, Argentina]	Accepted
54108	25	17	25	30	The definition provided in the first part of section 10.2.1.2 is somehow confusing when compared to section 10.2.1.1. For example, products which are developed based on blending in situ and satellite data can be considered in both sections (e.g. CHIRPS, PERSIANN-CDR). Please replace the data set of PERSIAN-CDR (Ashouri et al., 2015) in the right section based on a clear definition and comparison of sections 10.2.1.1 and 10.2.1.2. [Husain Najafi, Iran]	Taken into account. The reference Ashouri et al. 2015 is removed from section 2.1.1.
48936	25	19	25	25	The 2 mentions of "see Technical Annex on observations" seem to imply that there would be additional information in the Observational Annex on the subject of derived products and regionalization of global datasets. The current FOD Observational Annex lists specific datasets used in the chapter tables and figures, and does not offer descriptive text of data types. Would it be helpful to either cite specific datasets listed in the Observational annex here, or reference 1.4 or subsections thereof? [Chaincy Kuo, United States of America]	Rejected (The list of datasets are provided in Tables of the chapter with specific references as data sources).
20930	25	28	25	29	Another good example: Dietzsch, F., A. Andersson, M. Ziese, M. Schröder, K. Raykova, K. Schamm and A. Becker, (2017), A Global ETCCDI-Based Precipitation Climatology from Satellite and Rain Gauge Measurements, Climate, Vol 5(9), doi:10.3390/cli5010009 [Gwenaelle GREMION, Canada]	Accepted (The reference is added)
41358	25	30			Note data go back more than 100 years, see p27-L28 [Debra Roberts, South Africa]	Rejected. The discussion here is about combined products using in-situ radar and satellite so in my opinion will be very hard to find product with more than 100 years
52294	25	37	25	37	Hyphen missing in "convection-permitting". [Sergio Henrique Faria, Spain]	Accepted (Editorial - Copyedit to be completed prior to publication)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48938	25	40	25	44	The mention of "see Technical Annex on observations" seem to imply that there would be additional information in the Observational Annex on the subject of regionalization of reanalysis datasets. The current FOD Observational Annex lists specific datasets used in the chapter tables and figures, and does not offer descriptive text of data types. Would it be helpful to either cite specific datasets listed in the Observational annex here, or reference 1.4 or subsections thereof? [Chaincy Kuo, United States of America]	Rejected (The list of datasets are provided in Tables of the chapter with specific references)
20932	25	43	25	44	It seems like this is an appropriate place to mention the scarcity of data over Africa. I know the chapter mentions Africa 3 pages later but I feel like it would read better to address each continent here. Also, what about Northern Asia? Does it have the same issue with a lack of data as Africa? [Gwenaelle GREMION, Canada]	Taken into account. Text is added.
20936	26	3	26	6	Hihg-resolution satellite data could be mentioned here as an important source of information to study UHI, e.g. LST (Land Surface Temperature) is an important satellite-derived parameter to obain information on the spatial pattern of termperature over cities. [Gwenaelle GREMION, Canada]	Rejected. The section on urban observations has been moved to the urban box.
20934	26	5	26	6	This sentence is copied-pasted on page 29, line 4-6: consider removing it of one of the parts of the text. As there is a section (10.2.2.5) dedicated to obs for cities, this might be redundant. [Gwenaelle GREMION, Canada]	Accepted. Sentence removed.
54110	26	15	26	37	Please address the problem of detecting outliers in different approaches of QC and different results from applying existing approaches. How one can identify an outlier with an extreme event in the absence of metadata. [Husain Najafi, Iran]	Accepted. Text revised.
7684	26	17	26	17	"what measure the value", the word measure is confusing. It could be replaced by " level" or "degree" to facilitate the reader. [isabelle gouirand, Barbados]	Accepted. “degree”.
20938	26	23	26	23	I think "for instance" unnecessarily interupts the flow of this sentence and would be better omitted. [Gwenaelle GREMION, Canada]	Accepted.
29622	26	27	26	27	Relevant reference to be cited here: https://link.springer.com/article/10.1007/s10584-014-1100-9 [Rodrigo Manzanas, Spain]	Accepted.
20940	26	29	26	31	This sentence is a little convoluted. Perhaps something like "One example where efforts are made to produce quality-controlled data is in the UK (Blenkinsop et al., 2017) and the U.S (Nelson et al., 2016), where sub-daily precipitation records are provided. However, more concerted efforts are needed to cover more datasets." [Gwenaelle GREMION, Canada]	Accepted.
48294	26	37	26	40	Linked to my comment on 25/6-12 reference to Earth Observation datasets and their quality control and homogenisation should be included in these two sub-sections. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Some text was added about the copernicus and the homogenization related aspect.
13094	26	45	26	45	Providing full citations here: [Xu et al., 2013; Yan et al., 2010; Zhou et al., 2018).] Reference: Zhou, C., He, Y., and Wang, K., (2018). On the suitability of current atmospheric reanalyses for regional warming studies over China. Atmos. Chem. Phys., 18, 8113-8136. doi: 10.5194/acp-2017-966. [Zhou Chunlüe, United States of America]	Rejected. The suggested reference is not focused on the impact of the station relocation.
20942	27	3	27	3	Can you specifiy what kind of errors and what they stem from? [Gwenaelle GREMION, Canada]	Taken into account Text modified to specify the type of errors.
20944	27	13	27	13	What do you mean by improve? Do homogenization methods reduce error? Also, are these "warming estimates" on a global scale? [Gwenaelle GREMION, Canada]	Taken into account. Text modified for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8280	27	23	27	55	Suggestion is to add more references such as Jianbin Huang, Xiangdong Zhang, Qiyi Zhang, Yanluan Lin, Mingju Hao, Yong Luo,Zongci Zhao, Yao Yao, Xin Chen, Lei Wang, Suping Nie, Yizhou Yin5, Ying Xu and Jiansong Zhang, Recently amplified arctic warming has contributed to a continual global warming trend，Nature Climate Change, 10.1038/s41558-017-0009-5 [Zong Ci Zhao, China]	accepted
20946	27	32	27	33	I think it would read more clearly to separate these two clauses into two sentences (i.e. use a period rather than semicolon). [Gwenaelle GREMION, Canada]	rejected. Sentence is clear as it is
42458	27	37	27	37	Spain02 is beeng repbaced by Iberia01 [Rita M Cardoso, Portugal]	Accepted
21364	27	41	27	42	Incomplete areal coverage of rain gauges measurements is also discussed in Kidd et al. (2017). According to authors, the total area measured globally by all currently available rain gauges is equivalent to less than half a football field or soccer pitch. Moreover, many areas around the world (e.g. North Canada, Siberia, China, regions in Africa or South America) are beyond 100 km from the nearest rain gauge. Kidd, C., Becker, A., Huffman, G. J., Muller, C. L., Joe, P., Skofronick-Jackson, G., & Kirschbaum, D. B. (2017). So, how much of the Earth's surface is covered by rain gauges? Bulletin of the American Meteorological Society, 98, 69– 78. https://doi.org/10.1175/bams-d-14-00283.1 [Gwenaelle GREMION, Canada]	accepted
20948	27	41	27	42	Incomplete areal coverage of rain gauges measurements is also discussed in Kidd et al. (2017). According to authors, the total area measured globally by all currently available rain gauges is equivalent to less than half a football field or soccer pitch. Moreover, many areas around the world (e.g. North Canada, Siberia, China, regions in Africa or South America) are beyond 100 km from the nearest rain gauge. Kidd, C., Becker, A., Huffman, G. J., Muller, C. L., Joe, P., Skofronick-Jackson, G., & Kirschbaum, D. B. (2017). So, how much of the Earth's surface is covered by rain gauges? Bulletin of the American Meteorological Society, 98, 69– 78. https://doi.org/10.1175/bams-d-14-00283.1 [Gwenaelle GREMION, Canada]	Rejected (this comment is a duplication of #21364
29626	27	42	27	42	Relevant reference to be cited here: https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/joc.5249 [Rodrigo Manzanas, Spain]	Response : rejected This paper is already used in 10.2.2.7 where it fits best.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30124	27	42			O and Foelsche (2018) have investigated the relationship between station density and area averaged precipitation amount based on a dense (150 stations in an area of 300 km²) station network (Kirchengast et al.) in the European Alpine region. They found that for capturing the area averaged precipitation amount of heavy summertime precipitation events on a daily (hourly) basis with a normalised root mean square error of less than 20 % at least 2 to 5 (12) stations in that 300 km² area are required. A similar realationshipt was found by Villarini et al. (2008) in a network of 50 stations in an area of 135 km² in south-western England. These references could be added to this paragraph to give some illustrative examples on the importance of station densities. O, S., and Foelsche, U. (2018). Assessment of spatial uncertainty of heavy local rainfall using a dense gauge network. Hydrology and Earth System Sciences Discussions, 1–21. doi:10.5194/hess-2018-517. Kirchengast, G., Kabas, T., Leuprecht, A., Bichler, C., and Truhetz, H. (2014). WegenerNet A Pioneering High-Resolution Network for Monitoring Weather and Climate. Bulletin of the American Meteorological Society, 95(2), 227–242. doi:10.1175/BAMS-D-11-00161.1 Villarini, G., Mandapaka, P. V., Krajewski, W. F., and Moore, R. J. (2008). Rainfall and sampling uncertainties: A rain gauge perspective. Journal of Geophysical Research, 113(D11). doi:10.1029/2007JD009214 [Heimo Truhetz, Austria]	accepted (a part from the 2008 paper that is pre-AR5)
14428	28	8	28	12	I recommend to include the reference of APHRODITE (Asian Precipitation-Highly-Resolved Observational Data Integration Towards Evaluation of Water Resources) because this data often uses in the studies of precipitatoin over the South, Southeast, and East Asia. The reference is Yatagai, A., K. Kamiguchi, O. Arakawa, A. Hamada, N. Yasutomi, and A. Kitoh (2012): APHRODITE: Constructing a Long-Term Daily Gridded Precipitation Dataset for Asia Based on a Dense Network of Rain Gauges. Bulletin of the American Meteorological Society, vol. 93, No. 9, 1401-1415, DOI:10.1175/BAMS-D-11-00122.1. [Shiori Sugimoto, Japan]	Rejected. In this section we are assessing the gridding methodologies.
20950	28	15	28	15	Kriging techniques? I'm not sure exactly who you'd like to read the full report, but I feel like not as many people will recognize this technique. It may be useful to define what this technique does. [Gwenaelle GREMION, Canada]	Accepted. Kriging has been defined in the Glossary.
21366	28	24	28	24	Precipitation and its derivatives - like drought indices. In Hellwig et al (2018) Interpolation method problem is linked to the scale and resolution of the data. "The results suggest that absolute values of low-resolution data sets may not be suitable to use for an assessment of the hydrological conditions at the scale of small headwater catchments, whereas relative measures for determining periods of drought are more trustworthy. For large river basins the resolution of the data set is less relevant, but different interpolation methods still lead to different results for different products". Hellwig, J., Stahl, K., Ziese, M., and Becker, A.: The impact of the resolution of meteorological data sets on catchment-scale precipitation and drought studies, Int. J. Climatol., 38, 3069–3081, https://doi.org/10.1002/joc.5483, 2018. [Gwenaelle GREMION, Canada]	Noted. Reference has been added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20952	28	24	28	24	Precipitation and its derivatives - like drought indices. In Hellwig et al (2018) Interpolation method problem is linked to the scale and resolution of the data. "The results suggest that absolute values of low-resolution data sets may not be suitable to use for an assessment of the hydrological conditions at the scale of small headwater catchments, whereas relative measures for determining periods of drought are more trustworthy. For large river basins the resolution of the data set is less relevant, but different interpolation methods still lead to different results for different products". Hellwig, J., Stahl, K., Ziese, M., and Becker, A.: The impact of the resolution of meteorological data sets on catchment-scale precipitation and drought studies, Int. J. Climatol., 38, 3069–3081, https://doi.org/10.1002/joc.5483, 2018. [Gwenaelle GREMION, Canada]	Noted. Reference has been added.
30122	28	28			change "Austrian" to "European"; the referred dataset (Isotta et al. 2014) covers the whole Alpine region, not only the Austrian part. [Heimo Truhetz, Austria]	accepted. text revised
56700	28	40	29	18	Additional references can be provided for the urban heat island effect. [Kilkis Siir, Turkey]	Rejected. This text is now moved to a urban box and should be then rather reduced in the SOD
7978	28	54	28	55	REPLACE CURRENT sentence by more correct statement: Generally, the heat island occurs in cities during the afternoon, the evening and at night because the urban area absorps heat stronger during daytime and because the rural area cools during nighttime more rapidly than the city. In contrast, in the morning cities are sometimes cooler than the surrounding rural area (e.g., Theeuwes et al, 2015, see https://iopscience.iop.org/article/10.1088/1748-9326/10/11/114022/meta) [Bert Holtslag, Netherlands]	Accepted. Text modified for the SOD.
51006	28	55	28	55	Although this statement on urban heat island effects of 10-12 degrees may be correct, it runs the risk as being used in future citations as a typical value. It would be better to report a typiacl (order of magnitude) heat island effect number, with this extreme number as an indication of its variability [Bart Van den Hurk, Netherlands]	Taken into account. Text modified and moved to the urban climate box.
46266	29	4	29	10	What is the meaning of "network monitoring station in cities" in this section? [sadegh zeyaeyan, Iran]	Noted
8900	29	4	29	10	What is the meaning of "network monitoring station in cities" in this section? [Mohammad Javad Zareian, Iran]	duplication of 46266
57542	29	4	29	10	What is the meaning of "network monitoring station in cities" in this section? [Sahar Tajbakhsh Mosalman, Iran]	duplication of 46266
20954	29	4	29	10	Why is there a scarcity of data in the city? Given that cities have large populations, the issue can't be a lack of personel. Is it because there are not reliable place to house measuring stations? Interference of some kind? [Gwenaelle GREMION, Canada]	Taken into account. This is because of the WMO standard, meteorological station can not be located inside cities
48810	29	4			Please standardize “Urban heat islands (UHI): sometimes appears in capital letters other sensitive, sometimes with (UHI) other without. [António Lopes, Portugal]	editorial
46930	29	5	29	5	10.2.2.5 What are "external climatic drivers"? [Laura Gallardo, Chile]	Accepted. Text removed
46748	29	5	29	29	10.2.2.5 What are "external climatic drivers"? [Laura Gallardo, Chile]	Duplication of 46930
48932	29	12	29	12	Currently the FOD Observational Annex only list observational data. Does the author intend to refer the reader for additional descriptions of observational network [Chaincy Kuo, United States of America]	Noted. Due to length limit the reader is invited to check by him/her self the mentioned papers in the technical annex

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51476	29	21	29	40	The discussion of difficulties and uncertainties related to using observations and observation-based data sets in mountainous areas is insufficient. It misses the most important problems: 1. Most stattions are located in valleys or low areas and not representative for the whole area. 2. Even if there are mountain-top stations, some parameters are notoriously difficult to measure there, especially (solid) precipitation. Uncorrected values may easily be a factor of 2 too low. 3. Interpolation needs to consider vertical gradients, but these gradients are typically variable in time but also in space. 4. Weather divides often form along crests, leading to anisotropic correlation patterns which are rarely considered in OI or Kriging type of interpolations. All this implies a higher degree of uncertainty in those areas, which is valid especially for global or continental-scale data sets, relying on fewer stations and less sophisticated methods for considering topographic influences (if at all). The discussion of gridded data sets for mountain regions will hopefully include this, but nevertheless, also for direct observations the problems (solid precipitation for example) need to be pointed out clearly. Also the problem of disentangling snow and clouds as well as the occurence of subpixel orographic clouds need to be mentioned with respect to satellite-based observations. [Petra Seibert, Austria]	Accepted. Text has been modified for the SOD with the help of a CA.
41360	29	21			How important are mountain areas in climate models, in relation to their area? Mountains occupy a relatively smaller area on land compared to non-mountain areas. Do they have a relatively larger impact on climate? Therefore, how important are inaccuracies in mountain observational data? [Debra Roberts, South Africa]	Taken into account. Information about impact of mountains areas on regional climate is discussed in details in section3 of this chapter. The focus in section2 is more on the challenge related to observations in complex terrain.
55738	29	24	29	24	It is important to also state that spatial climate datasets have been developed for the conterminous United States at an appproximate 800m resolution with interpolation of long-term averages performed using PRISM (Parameter-elevation Relationships on Independent Slopes Model). This has been successfully applied to mountainous environments when there is often a lack of data. Please ignore if covered elsewhere. Relevant papers: Daly C, Halbleib M, Smith JI, Gibson WP, Doggett MK, Taylor GH, Curtis J, Pasteris PP (2008) Physiographically sensitive mapping of climatological temperature and precipitation across the conterminous United States. Int J Climatol 28:2031–2064. Daly C, Smith JI, Olson KV (2015) Mapping atmospheric moisture climatologies across the conterminous United States. PLoS One 10: e0141140. [Iain Robertson, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. New text is now introduced for the SOD.
55740	29	24	29	32	In recent years, an extensive networks of data loggers have been deployed to enable relative changes in temperature across small spatial scale to be investigated especially in mountainous environments. Relevant paper: Bunn, A. G., Salzer, M. W., Anchukaitis, K. J., Bruening, J. M., & Hughes, M. K. (2018). Spatiotemporal variability in the climate growth response of high elevation bristlecone pine in the White Mountains of California. Geophysical Research Letters, 45, 13,312– 13,321. https://doi.org/10.1029/2018GL080981 [Iain Robertson, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. New text is now introduced for the SOD.
52296	29	34	29	40	Multiple grammar errors. Please revise. [Sergio Henrique Faria, Spain]	Accepted. Text corrected for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21368	29	40	29	40	Data representativeness is generally strongly dependent on local conditions. This can be a problem especially in case of lower resolution products. Schwarz et al. (2018) analysing solar radiation data,delivered by Satellite Application Facility on Climate Monitoring (CM-SAF) showed that monthly stations observations can largely be considered representative of a 1-degree grid, but apart from the tropical, mountainous, and some coastal regions which cannot be well captured. Schwarz, M., Folini, D., Hakuba, M. Z., Wild, M. (2018). From Point to Area: Worldwide Assessment of the Representativeness of Monthly Surface Solar Radiation Records. JGR Atmospheres 123, 24, 13857-13874. doi.org/10.1029/2018JD029169. [Gwenaelle GREMION, Canada]	Not applicable. New text is now introduced for the SOD.
20956	29	40	29	40	Data representativeness is generally strongly dependent on local conditions. This can be a problem especially in case of lower resolution products. Schwarz et al. (2018) analysing solar radiation data,delivered by Satellite Application Facility on Climate Monitoring (CM-SAF) showed that monthly stations observations can largely be considered representative of a 1-degree grid, but apart from the tropical, mountainous, and some coastal regions which cannot be well captured. Schwarz, M., Folini, D., Hakuba, M. Z., Wild, M. (2018). From Point to Area: Worldwide Assessment of the Representativeness of Monthly Surface Solar Radiation Records. JGR Atmospheres 123, 24, 13857-13874. doi.org/10.1029/2018JD029169. [Gwenaelle GREMION, Canada]	Duplication of 21368
14084	29	51	29	51	Add before Dosio et al.: "The differences among gridded precipitation datasets can generate significant uncertainties in deriving precipitation characteristics; the uncertainties vary according to regions, seasons, and statistical properties (Kim et al. 2015; Kim and Park 2016)." [Jinwon Kim, Republic of Korea]	Accepted
48912	30	1	30	1	This is the first time CORDEX is mentioned in the chapter, so it would be helpful to spell out the acronym. [Chaincy Kuo, United States of America]	Editorial
46934	30	1	30	200	10.2.3.1 What about remote sensing and monitoring aerosol and gaseous loadings? There are significant developments in this area and it can be very relevant for model evaluation and application. Connect with chapter 6 [Laura Gallardo, Chile]	Rejected. Due to length limitation, we decided to keep the description of this type of observation in chapter 6.
51008	30	2	30	2	larger than what? [Bart Van den Hurk, Netherlands]	Accepted (text modified)
46764	30	2	30	30	10.2.3.1 What about remote sensing and monitoring aerosol and gaseous loadings? There are significant developments in this area and it can be very relevant for model evaluation and application. Connect with chapter 6 [Laura Gallardo, Chile]	Duplication of 46934
54112	30	20	30	20	It is suggested that the length of available observation is added as a separate sub-section of 10.2.2 (before sub section of other sources of uncertainty). [Husain Najafi, Iran]	Rejected. Due to length ;limit this section on observation should be rather reduced for the SOD. We believe that length of the available observation can be easily retrieved from the technical annex.
41362	30	30			Baseline period affects the meaning of anomalies, but not the absolute measures. Why do countries not report direct measures? To allow comparability between regions? [Debra Roberts, South Africa]	Not applicable: due to length limit this section has been removed and a part of the text moved in the introduction

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46932	30	32	30	34	10.2.3.1 Is the effort by the AMS unique or is this call to participate in it? This sounds prescriptive. [Laura Gallardo, Chile]	rejected: this is just an example, not a prescription. There are also the climate bulletins from the C3S service of Copernicus and others for instance in Japan (Climate Change Monitoring Report published by JMA), but it is not clear how to cite them
20960	30	45	30	45	One of the perfect examples for that are CM-SAF (Satellite Application Facility on Climate Monitoring) data records (www.cmsaf.eu) [Gwenaelle GREMION, Canada]	Noted: No publication mentioned in the comment, it is not clear what could be added related to CM-SAF. However, the text has been revised to include some new text and publications
20958	30	53	30	53	other surface and atmospheric parameters such as? [Gwenaelle GREMION, Canada]	Accepted. This sub-section should be modified and reduced as some examples, add "snow depth, heat islands, surface winds or sunshine"
51010	30	55	30	55	delete "more" [Bart Van den Hurk, Netherlands]	Accepted. However, this phrase has been removed from SOD.
51012	31	3	31	23	this is a very generic assessment with quite a few references from before 2013 (which should have been assessed in AR5). What's the key message here? [Bart Van den Hurk, Netherlands]	Noted To evaluate LULC, we need information of super-high resolution data in AR6 world. Because the demand from end-users increase from the era of AR5, and also the potential of model performance of climate change has increased from AR5. Thus we adopt thinking on such high resolution information That's why we refer many papers before AR5 age.
51014	31	10	31	10	reanalysis -> reanalyses [Bart Van den Hurk, Netherlands]	Editorial. Corrected
41380	31	20	31	23	Is this paragraph saying that RCM models in general do not account for rising CO2? [Debra Roberts, South Africa]	Noted. Answer is the paragraph says that this is often the case. The rising CO2 is taken into account only by the boundary conditions. The cited Jerez et al. (2018) quantified how much impact this could have.
20962	31	26	31	43	What is the state of modelling precipitation processes in latitudes outside of the tropics and sub-tropics? [Gwenaelle GREMION, Canada]	Taken into account. Text edited
20964	31	30	31	32	I think something like "One such exmple is three dimensional radar observations that have made it possible to classify precipitation..." [Gwenaelle GREMION, Canada]	Taken into account. Text edited
20966	31	49	31	50	I'm not sure the use of predictors and predictands here is made clear enough for a non-specialist to understand. Perhaps clarify these terms better or use synonyms. [Gwenaelle GREMION, Canada]	accepted. detail added

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8922	31	51	32	5	I think it is worth mentioning the type of regional climate generator introduced in Greene et al. 2015 and references therein:Arthur M. Greene, Lisa Goddard, Paula L.M. Gonzalez, Amor V.M. Ines and James Chryssanthacopoulos, A climate generator for agricultural planning in southeastern South America, Agricultural and Forest Meteorology, 10.1016/j.agrformet.2015.01.008, 203, (217-228), (2015). The method differs from typical generators in two aspects: it allows for multi-variate approaches which are often relevant for applications (e.g, temperature and precipitation for agriculture), and that GCM information is utilized at the regional scale and the subregional variability is modeled based on the observations. [Paula LM Gonzalez, United Kingdom (of Great Britain and Northern Ireland)]	Rejected – we don't give a list of weather generator products here but discuss observational issues.
51018	32	2	32	2	"nice" is not a good qualifier, use "useful" instead [Bart Van den Hurk, Netherlands]	taken into account. Text modified.
54114	32	2	32	4	It is suggested to address multivariate downscaling methods which consider precipitation and temperature based on parametric/non parametric density functions. [Husain Najafi, Iran]	rejected. such detail is not relevant here. The text is on observations.
51020	32	7	32	7	vague statement. Contribution to what? [Bart Van den Hurk, Netherlands]	Taken into account. Text modified.
32476	32	22	32	55	I'm surprised there is no mention of tree rings anywhere here and the various drought atlas's. Is that because they don't fit under "Assimilation of data including paleoclimate"? Should they be mentioned somewhere? [Isla Simpson, United States of America]	Noted. Tree rings are a source of information in paleo data assimilation (a list of input data is included in the SOD in response to other comments). Standard drought atlases do not use data assimilation. They are discussed in other sections of the report (for instance section 2.3.1.2.1 and 3.3.2).
32474	32	25	32	25	I don't think it is entirely true that decadal predictions "must" be initialized from the observed state of all components". For example, the CESM decadal prediction large ensemble is only initialized with observation based ocean and sea-ice states while the land and atmosphere come from the model itself (Yeager et al 2018, BAMS, DOI: 10.1175/BAMS-D-17-0098.1). Suggest some looser wording e.g., "must" → "benefit from" [Isla Simpson, United States of America]	Not applicable. Text removed due to length limit for the SOD.
41364	32	26			Please explain 'full-field' initialization [Debra Roberts, South Africa]	Not applicable. Due to length limit text has been removed.
21370	32	31	32	31	Polkova et al. (2019) after analysis of 5 different initialization methods applied to MIKLIP decadal model (Marotzke et al., 2016), reported that no single method exists that is superior to the others, each affects model results in a different way. Polkova, I., Brune, S., Kadow, C., Romanova, V., Gollan, G., Baehr, J., Glowienka-Hense, R., Greatbatch, R.J., Hense, A., Illing, S., Köhl, A., Kröger, J., Müller, W.A., Pankatz, K., Stammer, D. (2019), Initialization and Ensemble Generation for Decadal Climate Predictions: A Comparison of Different Methods. Journal of Advances in Modeling Earth Systems 11, 1, 149-172. doi: 10.1029/2018MS001439. Marotzke, J., Müller, W. A., Vamborg, F. S., Becker, P., Cubasch, U., Feldmann, H., Kaspar, F., Kottmeier, C., Marini, C., Polkova, I., Polkova, I., Prömmel, K., Rust, H. W., Stammer, D., Ulbrich, U., Kadow, C., Köhl, A., Kröger, J., Kruschke, T., Pinto, J. G., Pohlmann, H., Reyers, M., Schröder, M., Sienz, F., Timmreck, C., & Ziese, M. (2016). MiKlip—A national research project on decadal climate prediction. Bulletin of the American Meteorological Society, 97(12), 2379–2394. [Gwenaelle GREMION, Canada]	Not applicable. Text removed due to length limit for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20968	32	31	32	31	Polkova et al. (2019) after analysis of 5 different initialization methods applied to MIKLIP decadal model (Marotzke et al., 2016), reported that no single method exists that is superior to the others, each affects model results in a different way. Polkova, I., Brune, S., Kadow, C., Romanova, V., Gollan, G., Baehr, J., Glowienka-Hense, R., Greatbatch, R.J., Hense, A., Illing, S., Köhl, A., Kröger, J., Müller, W.A., Pankatz, K., Stammer, D. (2019), Initialization and Ensemble Generation for Decadal Climate Predictions: A Comparison of Different Methods. Journal of Advances in Modeling Earth Systems 11, 1, 149-172. doi: 10.1029/2018MS001439. Marotzke, J., Müller, W. A., Vamborg, F. S., Becker, P., Cubasch, U., Feldmann, H., Kaspar, F., Kottmeier, C., Marini, C., Polkova, I., Polkova, I., Prömmel, K., Rust, H. W., Stammer, D., Ulbrich, U., Kadow, C., Köhl, A., Kröger, J., Kruschke, T., Pinto, J. G., Pohlmann, H., Reyers, M., Schröder, M., Sienz, F., Timmreck, C., & Ziese, M. (2016). MiKlip—A national research project on decadal climate prediction. Bulletin of the American Meteorological Society, 97(12), 2379–2394. [Gwenaelle GREMION, Canada]	Duplication of 21370
20970	32	36	32	36	I feel like simplifying past climate archives to "natural archives such as tree rings" does not communicate well the incredible breadth of past climate archives at our disposal, especially given that this section is titled "Assimilation of data including paleoclimate." There are terrestrial archives (e.g. tree rings, pollen, speleothems, lake sediments, glacial cores). Furthermore, there is no mention of marine archives (e.g. sediment cores, corals, microfossils, mollusks, carbonate deposits). In particular, geochemical proxies from these archives have provided vast amounts of both qualitative and quantitative data sets dating back hundreds of thousands of years. [Gwenaelle GREMION, Canada]	Taken into account. The variety of past climate archives is well illustrated in Chapter 2. Tree rings were given only as an example of an archive that is widely used in data assimilation but in the SOD a longer list of archives used in existing reanalyses.
44120	32	36	33	8	Many natural archives in addition to tree rings can be used to provide paleoclimate data for model initialization; these include isotopic proxies that can be used to measure temperature, humidity, ice cover, and past CO2 levels, among others, via analysis of carbonate shells and corals, eggshells, bones, ice cores, inorganic carbonate minerals, biomarkers, and many other substances. Perhaps brief description of the other sources and the parameter estimates they can provide will be of use to readers. [Sara Kahanamoku, United States of America]	Taken into account. This is not the purpose here to give a full overview of all the archives that can be used in data assimilation. Chapter 2 gives many examples of archives that provide records of past changes in a wider context. Tree rings were just an example of record that is widely used in data assimilation but a broader list of data sources used in existing reanalyses is given in the SOD.
32478	32	44	32	44	It's not clear to me what "a numerous series" means. Should it be "of numerous time series from various data sources" or something like that? [Isla Simpson, United States of America]	Taken into account. We have modified the text following the suggestion
51016	32	44	32	48	would be good to be a bit more explicit. What time period is intended here? "Paleo" is quite wide. And what data sources? [Bart Van den Hurk, Netherlands]	Taken into account. The paragraph included an explicit mention of the period intended ('past centuries'). The period of interest will also be included earlier in the section when the paleo reanalyses are introduced and the main data sources is mentioned in the SOD.
20972	33	2	33	3	You mention temporal scales here but you should probably include spaital (regional to global) here as well. [Gwenaelle GREMION, Canada]	Taken into account. Spatial scales are now mentioned in the SOD
7692	33	7	33	8	the statement seems strong and no element in the former sub-section allows the reader to reach this conclusion?. [isabelle gouirand, Barbados]	Taken into account. Text has been modified for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7694	33	7	33	8	The statement is also vague by refering to " in some cold periods of the early 19th century" Could the author mention the specific cold periods they are referring to so as to facilitate the reader? [isabelle gouirand, Barbados]	Taken into account. Text has been modified for the SOD.
33348	33	7	33	8	Not clear what this sentence means. Robust evidence for what? [Erika Wise, United States of America]	Taken into account. This sentence was not clear and is now modified in the SOD. The reconstructions of the atmospheric state obtained in the reanalyses provide a robust evidence that large cooling (or warming) observed locally is often due to a local enhancement of larger-scale cold (or warm) conditions by the atmospheric circulation. For instance, the references provide examples related to specific atmospheric patterns such as weaker or stronger westerlies and a strong PNA pattern
46954	33	7	33	8	10.2.3.4. The statement can be inferred (I guess) from previous references in the text but it emerges out of the blue. Tell the story and the then state your assessment [Laura Gallardo, Chile]	Taken into account. The structure of the paragraph has been modified and sentences have been added to make a clearer link between the references and the statement.
32480	33	7	33	8	This statement seems rather out of the blue. What cold period is this referring to? Is it in particular regions? Or globally? Is there a reference that can be cited for this. I don't really see this discussed in this section. [Isla Simpson, United States of America]	The structure of the paragraph has been modified and sentences have been added to make a clearer link between the references and the statement
20974	33	7	33	8	You mention that there is robust evidence based on paleo-reanalysis that looks at the contribution of atmospheric circulation to cold periods in the 19th century but does this reanalysis not exist for earlier time periods too? Also, what about the marine record and oceanic circulation? [Gwenaelle GREMION, Canada]	Taken into account. The 19th century was just an example. This appears more clearly in the SOD. Unfortunately, only few studies based on reanalyses over the past millennium were focused on ocean circulation and thus there is much less evidence of a strong contribution of ocean circulation in past temperature changes using reanalyses.
20976	33	15	33	23	An enormous record of paleo-sea ice extent exists (e.g. Abram et al., 2013; Barker et al., 2005; Belt et al.; 2013; de Vernal et al., 2013; Halfar et al., 2013; Muller et al., 2011; among many, many others). [Gwenaelle GREMION, Canada]	Taken into account. References added in the SOD text
21372	33	23	33	23	Whereas the newest one - CERA-20C - provides 10-memebrs ensemble of reanalysis, what minimize errors in the observational record as well as model error (Laloyaux et al. 2018) (cited in other part) Laloyaux, P., de Boisseson, E., Balmaseda, M., Bidlot, J.-R., Broennimann, S., Buizza, R., et al. (2018). CERA-20C: A Coupled Reanalysis of the Twentieth Century. J. Adv. Model. Earth Syst. 10, 1172–1195. doi:10.1029/2018MS001273. [Gwenaelle GREMION, Canada]	Accepted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20978	33	23	33	23	Whereas the newest one - CERA-20C - provides 10-memebrs ensemble of reanalysis, what minimize errors in the observational record as well as model error (Laloyaux et al. 2018) (cited in other part) Laloyaux, P., de Boisseson, E., Balmaseda, M., Bidlot, J.-R., Broennimann, S., Buizza, R., et al. (2018). CERA-20C: A Coupled Reanalysis of the Twentieth Century. J. Adv. Model. Earth Syst. 10, 1172–1195. doi:10.1029/2018MS001273. [Gwenaelle GREMION, Canada]	Rejected (this comment is a duplication of #21372)
33350	33	33	33	49	Please either improve or remove section 10.2.4.2, which has several inaccuracies. 1) Crowdsourcing is not the same thing as citizen science, although it can be one form of citizen science. 2) There has been a recent move towards using the term community science rather than citizen science, and the IPCC should consider this change. Here are a couple of explanations from non-profits: https://urbanecologycenter.org/blog/community-science.html https://debspark.audubon.org/news/why-were-changing-citizen-science-community-science 3) The statement, "While they are far less reliable and accurate than professional observations..." is not correct, and there is a wide range of studies that have assessed the accuracy, most finding that "citizen scientists," are as accurate as professionals. References to consider: Buytaert, W., Zulkafli, Z., Grainger, S., Acosta, L., Alemie, T. C., Bastiaensen, J., … Zhumanova, M. (2014). Citizen science in hydrology and water resources: opportunities for knowledge generation, ecosystem service management, and sustainable development. Frontiers in Earth Science, 2(October), 1–21. https://doi.org/10.3389/feart.2014.00026 Cooper, C. B., Dickinson, J., Phillips, T., & Bonney, R. (2007). Citizen science as a tool for conservation in residential ecosystems. Ecology and Society, 12(2). https://doi.org/10.5751/ES-02197-120211 Crall, A. W., Newman, G. J., Stohlgren, T. J., Holfelder, K. A., Graham, J., & Waller, D. M. (2011). Assessing citizen science data quality: An invasive species case study. Conservation Letters, 4(6), 433–442. https://doi.org/10.1111/j.1755-263X.2011.00196.x Edo, M., Ortuño, N., Persson, P. E., Conesa, J. A., & Jansson, S. (2018). Emissions of toxic pollutants from co-combustion of demolition and construction wood and household waste fuel blends. Chemosphere, 203, 506–513. https://doi.org/10.1016/j.chemosphere.2018.03.203 Fuccillo, K. K., Crimmins, T. M., de Rivera, C. E., & Elder, T. S. (2015). Assessing accuracy in	Not applicable part of the text moved to the urban box.
48824	33	33			Please consider including a paragraph saying that about 50 % of data is not reliable or useful and more reaerch is needed. Meier, F., Fenner, D., Grassmann, T., Otto, M., & Scherer, D. (2017). Crowdsourcing air temperature from citizen weather stations for urban climate research. Urban Climate, 19, 170–191. https://doi.org/10.1016/j.uclim.2017.01.006 [António Lopes, Portugal]	Noted.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21374	33	45	33	45	The detailed state of the art was presented also by Zheng et al. (2018). Zheng, F., Tao, R., Maier, H. R., See, L., Savic, D., Zhang, T., et al. (2018). Crowdsourcing methods for data collection in geophysics: state of the art, issues, and future directions. Rev. Geophys. 56, 698–740. doi: 10.1029/2018RG000616 [Gwenaelle GREMION, Canada]	Not applicable
20980	33	45	33	45	The detailed state of the art was presented also by Zheng et al. (2018). Zheng, F., Tao, R., Maier, H. R., See, L., Savic, D., Zhang, T., et al. (2018). Crowdsourcing methods for data collection in geophysics: state of the art, issues, and future directions. Rev. Geophys. 56, 698–740. doi: 10.1029/2018RG000616 [Gwenaelle GREMION, Canada]	Duplication of 21374
21376	33	49	33	49	One of the recent examples for such a complementation of traditional data (from rain gauges and radars) by crowdsourcing rainfall data can be found at Yang and Ng (2019) Yang, P., Ng, T. L., (2019). Fast Bayesian Regression Kriging Method for Real-Time Merging of Radar, Rain Gauge, and Crowdsourced Rainfall Data. Water Resources Research 55, 4, 3194-3214. doi.org/10.1029/2018WR023857 [Gwenaelle GREMION, Canada]	Not applicable, text removed,
20982	33	49	33	49	This is great! But what kind of issues might we anticipate with heterogenous data sets? Also, are we looking at citizen science efforts to address the high-resolution data scarcity in urban areas? [Gwenaelle GREMION, Canada]	Not applicable, text removed,
20984	33	49	33	49	One of the recent examples for such a complementation of traditional data (from rain gauges and radars) by crowdsourcing rainfall data can be found at Yang and Ng (2019) Yang, P., Ng, T. L., (2019). Fast Bayesian Regression Kriging Method for Real-Time Merging of Radar, Rain Gauge, and Crowdsourced Rainfall Data. Water Resources Research 55, 4, 3194-3214. doi.org/10.1029/2018WR023857 [Gwenaelle GREMION, Canada]	Duplication of 21376
54102	34	1	39	42	Some models are neglected in this part for derivation of regional messages. For example, the application of optimal fingerprint in detection and attribution of climate change. It is suggested that these kinds of methods be provided in a new section with relevant citations. [Husain Najafi, Iran]	rejected - fingerprinting is not a climate model, but a diagnostic approach based on climate models.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45522	34	1	64	1	In my opinion a key outcome of this section should be about the confidence we have in the various techniques available to generate climate infromation and more importantly future climate information. This confidence is dependent upon the performance of the methods to reproduce present climate (as mentioned here) but it is also dependent on other factors such as the predicitve skill of the method and even the ability of the methods to represent uncertainties. A table summarizing assumptions, overall performance and possibly the confidence in projections would be great. I am happy to have a chat if this is not very clear. [Di Luca Alejandro, Australia]	Noted; we have added a table summarizing the assumptions underlying different model types in simulating regional climate change. But additionally, whether a specific model is adequate for projecting regional climate depends on many factors including the relevant climatic phenomena, the specific climate and even the considered impact. Furthermore, also the different experiment types depend on a very different set of assumptions (discussed in Section 10.3.2), again depending on many factors. Thus, it is impossible to give any concise recipe in addition to the procedural steps on constructing regional climate information discussed in Section 10.5.4. Nevertheless, we link the ne table directly to the relevant subsections, where further detail is given.
30780	34	7	34	19	part of this has been already written in sec 10.1, could be shortened or removed here [Annalisa Cherchi, Italy]	taken into account – text has been shortened, but some redundancy is required
32140	34	10			regional ocean models are missing [Samuel Somot, France]	taken into account: coupled ocean-atmosphere RCMs have been assessed
31358	34	25	34	25	"The most relevant types of models" would probably be better than "the most relevant models" [Gerhard Krinner, France]	Accepted: Text has been changed
31360	34	25	34	25	This whole section is vert textbook-like, almost inevitably. Maybe it would be good to try to streamline it more towards assessing the uestion: are the models we have good enough for what we want them to tell us?" (I know that's much easier said than done) [Gerhard Krinner, France]	Taken into account: the section has been shortened. Assumptions underlying different model types have been added and adequacy for purpose is discussed.
30782	34	31	34	31	"regional climate modelling", you probably mean "global modelling for regional opportunities" [Annalisa Cherchi, Italy]	taken into account – text modified
31350	34	31	34	31	"Typical models adnd model chains" is a bit confusing. Maybe "Typical model types and chains" would be better? [Gerhard Krinner, France]	accepted – text modified
31352	34	38	34	38	The acronym GCM is defined on page 10 as meaning "global climate model" (implicitly meaning "coupled" in most cases), and is used consistently as such, which is fine (that is, it is not used in the more restrictive sense "general circulation model"). However, as it often used, it might be useful from time to time to redefine it? [Gerhard Krinner, France]	Accepted. In the first sentence GCMs are defined as "global climate models"
32142	34	38			usually variable resolution GCM are put in the RCM family as their main goal is to improve the resolution over a region. It means that LAM (limited area models) are only a category of the RCM family [Samuel Somot, France]	Rejected. Here global models are discussed. High resolutions and variable GCM's are a subset of it. We keep the title as it is.
30784	34	40	34	41	remove up to "Although the" included [Annalisa Cherchi, Italy]	Rejected. These lines form an integral part of the text and the information is necessary.
20986	34	40	34	55	I know GCMs stand for Global Climate Models but this needs to be written out entirely the first time it's introduced.The same goes for ESMs and MIPs. Most people outside of the modeling community are not likely to know what these are. [Gwenaelle GREMION, Canada]	Accepted. GCM Is now introduced in the foregoing paragraph
30786	34	41	34	41	insert "In AR5, the" before "nominal resolution" [Annalisa Cherchi, Italy]	Rejected. In the sentence a reference is made to CMIP 5. AR5 only assesses the results of CMIP5.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30788	34	42	34	42	change "is" with "has been [Annalisa Cherchi, Italy]	Rejected. Structure is grammatically correct
30790	34	42	34	42	insert "but" before "their results" [Annalisa Cherchi, Italy]	Rejected. The word "Although" is used at the beginning of the sentence and "but" is therefore not needed.
32144	34	42			should we speak about effective resolution here. 200 km resolution means 600 to 1000km effective resolution. We should not let think a not-well informed reader that a 200km GCM can reproduce phenomena at the 200km spatial scale. [Samuel Somot, France]	Accepted. Text changed and a reference is made to Klaver et al. 2019, accepted in ASL.
30792	34	47	34	50	remove up to "Despite these efforts," included [Annalisa Cherchi, Italy]	Rejected. This sentence is necessary for the argument in this paragraph
32482	34	49	34	49	I think enhancing the ensemble size is used not just “to better capture internal variability” but to also accurately determine the response to forcings. Suggest adding that in. [Isla Simpson, United States of America]	Accepted. "and more accurately determine the response forcing" is added.
30794	34	50	34	50	insert "Since AR5," before "the progress in reducing" [Annalisa Cherchi, Italy]	Accepted. Inserting AR5 better defines the time line. Text modified.
30796	34	51	34	51	change "Several" with "Now for AR6, several" [Annalisa Cherchi, Italy]	Accepted.CMIP6 is indeed an important input for AR6. Text changed
31354	34	51	34	51	"progress has been limited": True, progress has not been infinite. However, it does sound a bit negative to me, almost like "very little progress". Is that intended? [Gerhard Krinner, France]	Accepted. Indeed limited can be interpreted very negative. Text changed with « moderate »
30798	34	51	34	52	change "this limitation" with "some of these limitations" [Annalisa Cherchi, Italy]	Accepted. Text changed
30800	34	52	34	55	you could simple refer to ch3 for the full list, and eventually keep here as example only the most relevant for regional climate [Annalisa Cherchi, Italy]	Taken into account. To reduce the length of the chapter a reference is made to the list of MIPS in chapter 3.
20992	35	1	37	1	Possibly include sentence(s) on the integration/comparison/future of climate model development across the different model communities (e.g GCMs and RCMs), as discussed in the WCRP Strategic Plan (https://www.wcrp-climate.org/images/documents/WCRP_Strategic_Plan_2019/WCRP-Strategic-Plan-2019-2028-FINAL-c.pdf) which mentions: 'Frameworks for model evaluation and uncertainty estimation are required, as is collaboration across model development communities. ', this is also mentioned in: Langendijk et al. 2019 https://doi.org/10.3389/fenvs.2019.00006 . [Gwenaelle GREMION, Canada]	rejected. The WCRP strategic plan does not spell out these issues yet, it just highlights the need to address them. Given the limited space we therefore decided not to include a reference.
30802	35	4	35	8	some words also for GMMIP? [Annalisa Cherchi, Italy]	Accepted. "and GMMIP aims at better understanding and predicting monsoons" is added.
32146	35	6	35	8	This points is largely unknown I would say. For example in CORDEX, I don’t think that the GCMs with higher spatial resolution in CMIP5 have been favoured by RCM groups. Also it is not clear that resolution plays a key rôle in results of the study of Mc Sweeney et al. 2015 (already cited in the chapter) for example. This is probably not because higher-resolution GCMs are not better per se but more likely because they are less well tuned due to their cost. [Samuel Somot, France]	Not applicable. Text has been removed.
30804	35	10	35	14	this part should be expanded/adjusted to be an assessment [Annalisa Cherchi, Italy]	Rejected. This is a model description. Assessment of model performance will follow in Section 10.3.3.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32148	35	11			Among the first GCMs with variable resolution, I would better cite the Déqué and Piedelievre 1995 with a quite stronger impact in the literature : Déqué, M., and J. Ph Piedelievre. "High resolution climate simulation over Europe." Climate dynamics 11.6 (1995): 321-339. [Samuel Somot, France]	Accepted. Reference added
15380	35	17	36	12	A rare example of RCM for a large mountainous territory: a climate analysis for the Russian part of the Altai-Sayan region and describes modern trends in climate change for 1961–1990 and 2007–2016. The forthcoming climate change was analyzed for 1990-1999 (baseline period taken as a reference to assess future changes), 2030-2039 (near-term perspective), 2050-2059 (mid-term perspective), and 2090-2099 (long-term perspective) using a 25 km horizontal resolution regional climate model developed by the Voeikov Main Geophysical Observatory. The following IPCC scenarios were used: RCP8.5 (2030–2039, 2050–2059, 2090–2099) and RCP4.5 (2090–2099). https://wwf.ru/en/resources/publications/booklets/analiz-i-prognoz-izmeneniy-klimata-v-rossiyskoy-chasti-altae-sayanskogo-ekoregiona-i-na-prigranichny/ [Oksana Lipka, Russian Federation]	Noted : It is not clear if the reviewer feels that this document should be cited. However, there are many examples of RCM simulation for mountainous territory, several of which are cited throughout the chapter.
42460	35	22	35	24	Two way-nested simulations imply feedbacks between RCM nests. The sentance should be clarifed, now it is a bit misleading [Rita M Cardoso, Portugal]	Accepted : Text modified to refer specifically to situations where an RCM is two-way nested with a GCM, to be consistent with the rest of the paragraph.
32150	35	26			those assumptions are very well listed and illustrated in Laprise et al. 2008 : Laprise, R. R. D. E., De Elia, R., Caya, D., Biner, S., Lucas-Picher, P. H., Diaconescu, E., ... & Separovic, L. (2008). Challenging some tenets of regional climate modelling. Meteorology and Atmospheric Physics, 100(1-4), 3-22. [Samuel Somot, France]	Not applicable ; text has been deleted. These assumptions are now part of Table 10.1 in the SOD, 10-34, line 8 - 10-35, line 2.
32154	35	33	35	40	I think that it is timely to speak about regional climate model internal variability citing some of the UQAM references [Samuel Somot, France]	Accepted : text modified to include unforced, internal variability.
50384	35	33	35	49	Useful reference: Diaconescu E P and Laprise R 2013 Can added value be expected in RCM-simulated large scales? Clim Dyn. 41 1769–800 [Silje Soerland, Switzerland]	Accepted
32152	35	33			The study of the large-scale consistency between GCM and RCM has been well studied in a multi-model approach (13 RCMs driven by ERA-40) by Sanchez-Gomez et al. 2009 : Sanchez-Gomez E., Somot S., Déqué M. (2009a) Ability of an ensemble of regional climate models to reproduce the weather regimes during the period 1961-2000. Clim. Dyn., 33(5):723-736, doi:10.1007/s00382-008-0502-7 [Samuel Somot, France]	Not Applicable – text has been shortened.
45524	35	36	35	36	I would replace "its own climate" by "its own large-scale circulation". [Di Luca Alejandro, Australia]	Rejected: the large-scale climate is only part of the climate that the RCM can generated independent of the driving data set.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28158	35	36	35	40	There has been significant efforts to improve spectral nudging to let RCM gets more freedom in small scale while maintaining better consistency to GCM for large scale, which widely applied for many fellow dynamical downscaling simulations. I think it is worth to mention such studies, for example, Kanamaru and Kanamitsu (2007), Hong and Chang (2012) Kanamaru, H. and Kanamitsu, M., 2007. Scale-selective bias correction in a downscaling of global analysis using a regional model. Monthly weather review, 135(2), pp.334-350. Hong, S.Y. and Chang, E.C., 2012. Spectral nudging sensitivity experiments in a regional climate model. Asia-Pacific Journal of Atmospheric Sciences, 48(4), pp.345-355. [Jiwoo Lee, United States of America]	Partly accepted. Kanamaru and Kanamitsu paper cited. Hong and Chang is not available for downloading and so cannot be assessed for it usefulness here, though it is not one of the origins of the method.
56482	35	42	10	44	But see Sorland et al 2018, https://doi.org/10.1088/1748-9326/aacc77. The text only makes sense if the biases of RCMs and GCMs are additive, which is not the case. RCMs inherit the large-scale circulation, not the biases. [Christoph Schär, Switzerland]	Rejected: RCMs also inherit biases in temperature and moisture fields. Also, the referenced paper shows reduced bias in the RCMs vs. driving GCMs, but it does not demonstrate if this is the result of RCM and GCM biases simply cancelling each or a true improvement in the regional simulation by better rendering of physical processes in the RCM.
30806	35	42	35	44	when it is the case that RCM are not driven by GCM? [Annalisa Cherchi, Italy]	Noted: When an RCM is driven by a reanalysis, for example.
50386	35	42	35	44	I would suggest to rephrase, as the garbage-in garbage-out problem is not used in favour for the RCMs, and this short paragraph is basically stating that this is always the case. In Sørland et al. 2018 this is discussed more in detail. [Silje Soerland, Switzerland]	Accepted – the text has been slightly adjusted.
32156	35	46	35	53	Note that the use of convection permitting RCM is also part of CORDEX now in the CORDEX FPS-convection. The phrasing is missleading [Samuel Somot, France]	Accepted: text revised to note that the RCMs typically have 10-50 km grid spacing. The CORDEX FPS is a special subset.
45526	35	46	35	55	It might be good to clarify that convection-permitting models do not fully resolve deep convection. [Di Luca Alejandro, Australia]	accepted, sentence added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39420	35	46	35	55	Better to describe successful results using convective-premitting experiments by RCMs. TC-related rainfalls (Takahashi et al. 2009), convective precipitations over the tropics (Takahashi et al. 2010, Dado and Takahashi 2017, Takahashi and Polcher 2019), convective precipitation including solid precipitation (Takahashi et al. 2013). Ref. Takahashi, H.G., T. Yoshikane, M. Hara and T. Yasunari, 2009: High-resolution regional climate simulations of the long-term decrease in September rainfall over Indochina, Atmos. Sci. Lett., 10, 14-18, doi:10.1002/asl.203. Takahashi, H.G., T. Yoshikane, M. Hara, K. Takata, and T. Yasunari, 2010: High-resolution modelling of the potential impact of land-surface conditions on regional climate over Indochina associated with the diurnal precipitation cycle. Int. J. Climatol., 30(13), 2004-2020, doi:10.1002/joc.2119. Dado, J.M.B., and H.G. Takahashi, 2017: Potential impact of sea surface temperature on rainfall over the western Philippines. Progress in Earth and Planetary Science (PEPS), 4, doi:10.1186/s40645-017-0137-6. Takahashi, H. G., and J. Polcher, 2019: Weakening of rainfall intensity on wet soils over the wet Asian monsoon region using a high-resolution regional climate model. Progress in Earth and Planetary Science, 6, 26, doi:10.1186/s40645-019-0272-3. Takahashi, H.G., N. N. Ishizaki, H. Kawase, M. Hara, T. Yoshikane, X. Ma, and F. Kimura, 2013: Potential impact of sea surface temperature on winter precipitation over the Japan Sea side of Japan: A regional climate modeling study. J. Meteor. Soc. Japan Ser. II, 91, 471-488, doi:10.2151/jmsj.2013-404. [Hiroshi Takahashi, Japan]	Rejected – this paragraph briefly lists research strands, it does not give comprehensive literature reviews of applications.
39422	35	46	35	55	Resolution-dependency and convective parameterization are very important issues here. The following can be helpful. Ref. Sugimoto, S., and H.G. Takahashi, 2016: Effect of Spatial Resolution and Cumulus Parameterization on Simulated Precipitation over South Asia. SOLA (Scientific Online Letters on the Atmosphere), 12A, 7-12, doi:10.2151/sola.12A-002. [Hiroshi Takahashi, Japan]	Noted, but not included as there are already several references to convection-permitting simulation that preceded the suggested paper and are thus more foundational.
20988	35	47	35	47	What time frame defines historical here? It may be better to put a rough number of years into the past. [Gwenaelle GREMION, Canada]	Accepted: There is no common starting year in CORDEX simulations, though many start at 1950 using GCM output.
54076	35	49	35	49	An indication of the range of appropriate resolutions would be useful here. Kendon et al (Nature Climate Change, 2014) used a resolution of 1.5km but other resolutions have been employed [Stephen Blenkinsop, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: The range is now discussed.
30808	35	49	35	50	remove from "Much finer" to "Therefore," included [Annalisa Cherchi, Italy]	Rejected : The sentence gives important physical information and motivation for doing convection-permitting simulation.
56484	35	49	35	50	the dominant cause of precipitation in the tropics, summer precipitation over land, and winter precipitation over sea [Christoph Schär, Switzerland]	Accepted: Text revised to be more inclusive.
42462	35	49	35	50	Much finer scale resolution is also needed to correctly represent convection over mountains (Coppola et al. 2019; Pontoppidan et al. 2017) Pontoppidan, M., Reuder, J., Mayer, S., & Kolstad, E. W. (2017). Downscaling an intense precipitation event in complex terrain: the importance of high grid resolution, Tellus A: Dynamic Meteorology and Oceanography, 69(1), 1271561. doi: 10.1080/16000870.2016.1271561. [Rita M Cardoso, Portugal]	Noted, but not included. Text has been modified, based on another reviewer's comment, to be succinctly more inclusive of areas of the world covered, without listing each one.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51022	35	49	35	52	Some reference to Atlas 5.6.3 could be made, where added value of convection permitting models for European climate assessment is being discussed [Bart Van den Hurk, Netherlands]	Noted, but the SOD version of Atlas 5.06 for Europe (viewed 2 January 2020) discusses properties of convection-permitting modelling for Europe but not its added value relative to driving GCMs.
50388	35	50	35	52	A new study also shows that the convection can be switch off at much at a coarser resolution than previously considered (Vargara, Ban, Panosetti, Schlemmer and Schär: Climate models permit convection at much coarser resolutions than previously considered. Submitted to Journal of Climate, April 2019) [Silje Soerland, Switzerland]	Accepted – text adjusted
31356	35	53	35	53	This sentence is a bit unclear. So what happens when the resolution becomes kilometric with these scaleaware parameterizations? [Gerhard Krinner, France]	Noted. The work cited does not discuss the behaviour of scale-aware parameterizations at those resolutions.
56486	35	53	35	55	Please list the early decade-long simulations in this area, e.g. Ban et al. 2014, Kendon et al. 2014 [Christoph Schär, Switzerland]	Accepted, but cited earlier as part of the convective-permitting modelling list.
32484	36	4	36	4	It's not at all clear to me why cloud-aerosol interactions should be missing as a consequence of only having atmosphere and land components, since this process is within the atmosphere. It seems like this is more a function of only having a regional domain, which means the aerosols have to be prescribed? Suggest clarification. [Isla Simpson, United States of America]	Accepted. Reworded to make clear cloud-aerosol interaction requires atmospheric chemistry and is thus an added complexity.
32158	36	5			For air-sea coupling, I would also cite the overview paper by Ruti et al. 2016 (already cited) for the Mediterranean region. [Samuel Somot, France]	Accepted
28160	36	7	36	7	Additional study that couples rivers in RCM: Lee et al. (2015). Lee, J.W., Hong, S.Y., Kim, J.E.E., Yoshimura, K., Ham, S. and Joh, M., 2015. Development and implementation of river-routing process module in a regional climate model and its evaluation in Korean river basins. Journal of Geophysical Research: Atmospheres, 120(10), pp.4613-4629. [Jiwoo Lee, United States of America]	Accepted
32160	36	7			Rivers : I would go for more pioneer works on the river coupling such as Carillo et al. 2012 (Carillo, A., Sannino, G., Artale, V., Ruti, P. M., Calmanti, S., & Dell'Aquila, A. (2012). Steric sea level rise over the Mediterranean Sea: present climate and scenario simulations. Climate dynamics, 39(9-10), 2167-2184.) or Sevault et al. 2014 (http://dx.doi.org/10.3402/tellusa.v66.23967) [Samuel Somot, France]	Accepted (partly) - Sevault et al cited, but Carillo et al. does not appear to use a river routing model and is focused on simulation of the Mediterranean.
32162	36	7			glaciers : Kotlarski, S., Jacob, D., Podzun, R., & Paul, F. (2010). Representing glaciers in a regional climate model. Climate dynamics, 34(1), 27. [Samuel Somot, France]	Accepted
32164	36	7			aerosols : the Nabat et al. 2015 reference is not the good one for interactive aerosols in ALADIN (however keep the old one as it is used well somewhere) : Nabat P., S. Somot, M. Mallet, M. Michou, F. Sevault, F. Driouech, D. Meloni, A. Di Sarra, C. Di Biagio, P. Formenti, M. Sicard, J.-F. Léon, and M.-N. Bouin (2015b) Dust aerosol radiative effects during summer 2012 simulated with a coupled regional aerosol-atmosphere-ocean model over the Mediterranean. Atm. Chem. Phys., 15, 3303-3326, doi:10.5194/acp-15-3303-2015. http://www.atmos-chem-phys.net/15/3303/2015/ [Samuel Somot, France]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42464	36	8	36	9	Coupled atmosphere-ocean simulations also allow the investigation of land-sea interactons, particularly in regions where oceanic upwelling influences the atmospheric circulation (Lima et al. 2019; Soares et al.2018) Lima DCA, Soares PMM, Semedo A, Cardoso RM, Cabos W, Sein DV (2019) How will a warming climate affect the Benguela coastal low-level wind jet? DOI: 10.1029/2018JD029574 Soares PMM, Lima DCA, Semedo A, Cardoso RM, Cabos W, Sein D (2018) Assessing the climate change impact on the North African offshore surface wind and coastal low-level jet using coupled and uncoupled regional climate simulations. Climate Dynamics https://doi.org/10.1007/s00382-018-4565-9 [Rita M Cardoso, Portugal]	Accepted
30810	36	11	36	11	the carbon cycle is not a model component but it represents the closure up of the coupling between ocean and terrestrial carbon biogeochemistry [Annalisa Cherchi, Italy]	Rejected. In the context of modelling, it represents another component system that could be part of the model.
14422	36	23	36	50	I think it is better to dicuss about snow cover impacts on the urban climate (For example, Mori and Sato 2015; Ito et al. 2018; the detail of references are shown in other comment cells). [Shiori Sugimoto, Japan]	Not applicable – text has been shortened and moved to box.
14424	36	23	36	50	I recommend to include this paper. Mori, K., and T. Sato (2015): Evaluating the Role of Snow Cover in Urban Canopy layer on the Urban Heat Island in Sapporo, Japan with a Regional Climate Model. Journal of the Meteorological Society of Japan, vol. 93, No. 5, 581-592, DOI:10.2151/jmsj.2015-039. [Shiori Sugimoto, Japan]	Not applicable – text has been shortened and moved to box.
14426	36	23	36	50	I recommend to include this paper. Ito. R., T. Aoyagi, N, Hori, M. Oh'izumi, H. Kawase, K. Dairaku, N. Seino, and H. Sasaki (2018): Improvement of Snow Depth Reproduction in Japanese Urban Areas by the Inclusion of a Snowpack Scheme in the SPUC Model. Journal of the Meteorological Society of Japan, vol. 96, No. 6, 511-534, DOI:10.2151/jmsj.2018-053. [Shiori Sugimoto, Japan]	Not applicable – text has been shortened and moved to box.
48826	36	31			More information about the types of models could be useful: RANS, LES, CFD, Prognostic/diagnostic, etc [António Lopes, Portugal]	Not Applicable – text has been shortened and moved to box.
58016	36	48	36	50	Halenka, T., M. Belda, P. Huszar, J. Karlicky, T. Novakova and M. Zak (2019): On the comparison of urban canopy effects parameterisation, Int. J. Environment and Pollution, Vol. X, No. Y, xxxx (in print) [Tomas Halenka, Czech Republic]	Not applicable – text has been shortened and moved to box.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
20990	36	48	36	50	Many modelling groups are considering and developing more sophisticated urban schemes in connection with the RCMs, though they are mainly used for individual case-study cities and not in the standard (e.g. CORDEX) simulations. Other possibly related examples: - Key Conclusions of the First International Urban Land Surface Model Comparison Project : https://doi.org/10.1175/BAMS-D-14-00122.1 - Developing a Research Strategy to Better Understand, Observe, and Simulate Urban Atmospheric Processes at Kilometer to Subkilometer Scales, https://doi.org/10.1175/BAMS-D-17-0106.1 - Huszar, P., Halenka, T., Belda, M., Zak, M., Sindelarova, K., and Miksovsky, J.: Regional climate model assessment of the urban land-surface forcing over central Europe, Atmos. Chem. Phys., 14, 12393-12413, https://doi.org/10.5194/acp-14-12393-2014, 2014. - Hamdi R., Duchêne F., Berckmans J., Delcloo A., Vanpoucke C., Termonia P. (2016). Evolution of urban heat wave intensity for the Brussels Capital Region in the ARPEGE-Climat A1B scenario. Urban Climate 17, 176–195. - Martilli A., Clappier A., Rotach M. (2002): An urban surface exchange parameterisation for mesoscale models. Boundary-Layer Meteorol. 104: 261–304. - Oleson K.W., Bonan G.B., Feddema J., Vertenstein M., Grimmond C.S.B. (2008): An urban parameterization for a global climate model. Part I: Formulation and evaluation for two cities. J. Appl. Meteorol. Climatol. 47, 1038–1060. [Gwenaelle GREMION, Canada]	Not applicable – text has been shortened and moved to box.
32166	36	49			Daniel et al. 2018 is finally Daniel et al. 2019 : Daniel M., Lemonsu A., Déqué M., Somot S., Alias A., Masson V (2019) Benefits of explicit urban parametrization in regional climate modelling to study climate and city interactions. Climate Dynamics, 52(50),2745-2764, doi:10.1007/s00382-018-4289-x http://link.springer.com/article/10.1007/s00382-018-4289-x [Samuel Somot, France]	Not Applicable – text has been shortened and moved to box.
32486	37	7	37	30	Perhaps Lombardozzi et al 2018, GRL, 45, 9889-9897 is another relevant reference for this section? [Isla Simpson, United States of America]	Rejected due to space restrictions.
20994	37	40	37	40	I would imagine the same is true for spring too when lakes warm faster? [Gwenaelle GREMION, Canada]	Noted. The assessment is based on available literature.
48072	38	2	38	2	There?s an entire section (10.3.1.3.5) which is listed in the TOC but empty at the moment. [WGI TSU, France]	Taken into account. For the SOD this has been resolved.
30816	38	6	38	6	title of subsection 10.3.1.4 could be "Statistical approaches to generate regional projections" [Annalisa Cherchi, Italy]	accepted
14552	38	6	38	17	For the sake of completeness, simple change factor (or delta change) approaches should be mentioned, in which simulated changes are applied to observed climate (as aposed to the change factor approach with WGs described in section 10.3.1.4.3 that generates an artificial time-series). These have not totally disappeared in impact studies because they are easy to apply. There are also versions of simple change factor approaches that modify the variability of the observed time series (e.g. Ruane et al. 2015, doi:10.1142/9781783265640_0003); for a recent application in agriculture see Webber et al. (2018, doi:10.1038/s41467-018-06525-2). [Stefan Fronzek, Finland]	taken into account – has been added.
32170	38	6	39	41	Section 10.3.1.4 : I feel that this section has too few references [Samuel Somot, France]	taken into account. References have been added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32168	38	8		17	what about the rôle of CORDEX in coordinated statistical downscalling. Isn't VALUE a project that can be considered as under the umbrella of (Euro-)CORDEX for example ? [Samuel Somot, France]	taken into account .
20996	38	37	38	39	Promising, possibly cite: ' Deep learning and process understanding for data-driven Earth system science, Markus Reichstein, Gustau Camps-Valls, Bjorn Stevens, Martin Jung, Joachim Denzler, Nuno Carvalhais & Prabhat , Nature 566, 195–204 (2019) ' [Gwenaelle GREMION, Canada]	accepted
32488	38	41	38	46	Other analogue methods consider using a linear combination of past events to build up the analogues e.g., Deser et al 2016b and Smoliak et al 2015 cited in other parts of the report. Perhaps this should be mentioned here. [Isla Simpson, United States of America]	taken into account – more appropriate method cited
56052	38	41	38	46	This paragraph contains statements without references. [Corti Susanna, Italy]	taken into account – references have been added.
46268	38	50	38	55	Bias adjustment is an important process in increasing the accuracy of using the GCM models. But this is different from temperature and rainfall. It should be referred in this section [sadegh zeyaeyan, Iran]	rejected – comment unclear
8902	38	50	38	55	Bias adjustment is an important process in increasing the accuracy of using the GCM models. But this is different from temperature and rainfall. It should be referred in this section [Mohammad Javad Zareian, Iran]	rejected – comment unclear
57544	38	50	38	55	Bias adjustment is an important process in increasing the accuracy of using the GCM models. But this is different from temperature and rainfall. It should be referred in this section [Sahar Tajbakhsh Mosalman, Iran]	rejected – comment unclear
14090	38	51	38	51	Consider replacing: "the bias or relative error between" -> "the bias or relative error of a chosen statistical property (e.g., mean, variability, probability distribution) between" [Jinwon Kim, Republic of Korea]	taken into account – phrased slightly differently as suggested
54554	38	53	38	55	Meaning isn't really clear here - Is the meaning that the downscaling part results from connecting the GCM model output with a local (e.g., point) ovservation? Given the confusion many experience regarding statistical downscaling vs. bias correction, it would be good to clarify here. [Linda Mearns, United States of America]	taken into account – has been rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42498	38	53	39	4	Bias adjustment can also be applied to the GCM prior to the dynamical downscaling by an RCM in order to reduce the GCM systematic climate biases. In this way, the RCM is to adjust and develop its own physically consistent weather and climate within the model domain and the non-linear relationships between variables are not destroyed, e.g. the GCM monthly mean is corrected towards a reanalysis and the climate variability from the GCM is retained either in present climate or future (Bruyère et al., 2014; Wang & Kotamarthi, 2015; Xu & Yang, 2012, 2015; Rocheta et al., 2017; Pontoppidan et al., 2018) Bruyère, C. L., J. M. Done, G. J. Holland, and S. Fredrick (2014), Bias corrections of global models for regional climate simulations of high-impact weather, Climate Dynamics, 43(7-8), 1847–1856, doi:10.1007/s00382-013-2011-6. Wang, J., and V. R. Kotamarthi (2015), High-resolution dynamically downscaled projections of precipitation in the mid and late 21st century over North America, Earth's Future, 3(7), 268–288, doi:10.1002/2015EF000304 Xu, Z., and Z.-L. Yang (2012), An improved dynamical downscaling method with GCMbias corrections and its validation with 30 years of climate simulations, Journal of Climate, 25(18), 6271–6286, doi:10.1175/JCLI-D-12-00005.1 Xu, Z., and Z.-L. Yang (2015), A new dynamical downscaling approach with GCMbias corrections and spectral nudging, Journal of Geophysical Research: Atmospheres, 120(8), 3063–3084, doi:10.1002/2014JD022958. Pontoppidan, M., Kolstad, E. W., Sobolowski, S., & King, M. P. (2018). Improving the Reliability and Added Value of Dynamical Downscaling via Correction of Large-Scale Errors: A Norwegian Perspective, Journal of Geophysical Research: Atmospheres, 123(21), 11,875-11,888. doi: 10.1029/2018JD028372. [Rita M Cardoso, Portugal]	noted. This issue is discussed in the Cross Chapter box on BA
20998	39	1	39	1	Revise "The most important difference with perfect prognosis is that" to "The most important difference with perfect prognosis as compared to bias adjustment is that". [Gwenaelle GREMION, Canada]	accepted, although phrased slightly different.
36644	39	1	39	4	"say "bias adjustment only links" rather than "bias adjustment can only link". It's a somewhat fine philosophical point, but this sentence does not describe what the different methods are capable of; it defines how we categorize different methods. Mathematically speaking, there is no clear dividing line between PP, BA, and WG. You could include other predictors such as synoptic weather typing as a conditioning variable in a bias adjustment, and multivariate bias adjustment arguably links all the variables being adjusted to one another. People use BA as a form of SD, and so on. I think it leads discussion about the methods astray to imply that the boundaries between them are rigid, so it's important to be careful about phrasing when we describe the differences between the methods. [Seth McGinnis, United States of America]	rejected – in a typical climate change setting, BA is not able to link, thus « can » is more appropriate
14092	39	6	39	6	Consider replacing: "the bias in the adjusted" -> "the bias of the chosen statistical property in the adjusted" [Jinwon Kim, Republic of Korea]	taken into account – text modified
46968	39	9	39	9	10.3.1.4.2 "Credibility": This is not a matter of belief ! [Laura Gallardo, Chile]	rejected – as we cannot verify, it is a matter of belief. There is a whole bunch of literature. Also see that the assumptions have been moved into a table.
31362	39	28	39	41	Section 10.3.1.3.3 lacks references [Gerhard Krinner, France]	taken into account – references have been added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51024	39	29	39	41	A remark on the fact that in many implementations attributes that relate to the day-to-day variability of weather are not changed when a future climate time series is constructed, only delta's that apply to a given quantile of a the variable of interest. This may give unrealistic future samples when temporal (or spatial) autocorrelation structures are expected to change in a future climate [Bart Van den Hurk, Netherlands]	taken into account – already mentioned under assumptions (see new table)
56054	39	29	39	41	References needed here as well. [Corti Susanna, Italy]	taken into account – references have been added.
14094	39	31	39	31	Add a reference after "variability": "varaibility (Kyriakidis et al., 2001) [Jinwon Kim, Republic of Korea]	rejected – reference not found, will consider more classical papers in FGD
30812	39	44	39	44	this section 10.3.2 could be drastically reduced to those types of experiments not extensively discussed in ch 3 but crucial for regional applications [Annalisa Cherchi, Italy]	taken into account – although some redundancy required. More links to previous chapters.
45528	39	44	39	44	Somewhere in this section the use of SST bias corrected RCM simulations could be discussed… [Di Luca Alejandro, Australia]	taken into account, but is discussed in BA box
30814	39	54	39	54	this section 10.3.2.1 is likely not needed. Time-slice experiments are not peculiar of regional applications [Annalisa Cherchi, Italy]	Rejected. Time slice are a type of experiments with GCMs that are used for regional downscaling, similar as the other type of experiments discussed in this subsection. It is a commonly used experiment for regional projections.
21000	40	1	40	12	Please consider to include the new, unique dataset that CORDEX-CORE will release in fall (publications are underway). It is a unique dataset that covers an extensive amount of regions around the world on ~22° resolution (more info: http://www.cordex.org/experiment-guidelines/cordex-core/) [Gwenaelle GREMION, Canada]	Noted. We will consider this when the data and publications are available.
32172	40	6			interesting to cite here the standard 1950-2100 period for CORDEX scenario runs ? [Samuel Somot, France]	Accepted; Period 195-2000 for CORDEX scenario runs is mentioned
21002	40	9	40	20	Again it is unclear to me if sea ice reconstructions from paleo archives are used for comparison. See citations provided from page 33. [Gwenaelle GREMION, Canada]	Rejected. No need to mention here specifically paleo reconstructions of SST
14098	40	13	40	13	"computationally cheaper" -> "computationally inexpensive" [Jinwon Kim, Republic of Korea]	Rejected. The simulations can be still expensive. « less expensive » is now used
56056	40	14	40	14	Davini et al. 2017 describes an experiment in AMIP mode with increasing resolution and ensemble members Davini, P., von Hardenberg, J., Corti, S., Christensen, H. M., Juricke, S., Subramanian, A., Watson, P. A. G., Weisheimer, A., and Palmer, T. N., 2017: Climate SPHINX: evaluating the impact of resolution and stochastic physics parameterisations in the EC-Earth global climate model, Geosci. Model Dev., 10, 1383-1402, doi:10.5194/gmd-10-1383-2017 [Corti Susanna, Italy]	Accepted. Reference is added
42500	40	17	40	17	add reference Sein, D. V., and Coauthors, 2015: Regionally coupled atmosphere-ocean-sea ice-marine biogeochemistry model ROM: 1. Description and validation. J. Adv. Model. Earth Syst., 7, 268–304, doi:10.1002/2014MS000357. [Rita M Cardoso, Portugal]	Accepted: Reference is added
32174	40	17			Time-slice for coupled RCMs are very questionable due to the spin-up time of the ocean that is often longer than the time slice. The question on how to initialize a 3D ocean model in 2070 is unsolved to my knowledge. [Samuel Somot, France]	Noted: This problem can be handled satisfactorily. It is not further discussed in the text.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21004	40	23	40	36	Currently these paragraphs read more as a list of literature, would it be possible to summarize the main outcomes of the studies in a more assessment style text? [Gwenaelle GREMION, Canada]	rejected– the text is not about assessing the outcomes of these studies. These studies are merely examples of how the approach is used.
50390	40	25	40	26	It is not only the bias in the GCM that is the main motivation to use the PGW approach, but the uncertainty related to the future circulation changs. i.e. a better representation of the current climate does not mean a more reliable projection (e.g. Zappa et al. 2013 doi: https://doi.org/10.1175/JCLI-D-12-00573.1). [Silje Soerland, Switzerland]	taken into account – reasoning has been added
42762	40	25	40	52	It should be noted that this method assumes tat climate variability is stationary in time and in general only corrects mean biases of the large scale circulation [Rita M Cardoso, Portugal]	rejected– no, it does not.
56522	40	26	40	28	Schär et al., 1996 presents a simpler PGW approach where only temperature and humidity are changed. However, in the later version, the PGW approach includes circulation changes as well. Please see Liu et al., 2016, Hentgen et al., 2019, Brogli et al., 2018. [References: Liu C, et al., (2016) Continental-scale convection-permitting modeling of the current and future climate of North America. Clim Dyn. https://doi.org/10.1007/s00382-016-3327-9; Hentgen, L., Ban, N., Kröner, N., Leutwyler, D., & Schär, C. (2019). Clouds in convection-resolving climate simulations over Europe. Journal of Geophysical Research: Atmospheres, 124, 3849– 3870. https://doi.org/10.1029/2018JD030150; Brogli, R., N. Kröner, S.L. Sørland, D. Lüthi, and C. Schär, 2019: The Role of Hadley Circulation and Lapse-Rate Changes for the Future European Summer Climate. J. Climate, 32, 385–404, https://doi.org/10.1175/JCLI-D-18-0431.1] [Nikolina Ban, Switzerland]	taken into account – text has been adjusted.
50392	40	29	40	29	would remove "garbage-in garbage-out problem" and inculde uncertainty in future circulation changes. [Silje Soerland, Switzerland]	rejected– it is a relevant aspect. But the other point has been added as well, and the term garbage is no longer used here
50394	40	29	40	33	Boundary conditions can also be taken from a GCM and then the climate change signal from the same GCM. See e.g. Kröner et al. 2016. doi: https://doi.org/10.1007/s00382-016-3276-3 and Brogli et al. 2019: https://doi.org/10.1175/JCLI-D-18-0431.1 [Silje Soerland, Switzerland]	taken into account, has been added
30818	40	30	40	30	maybe some more details on how these modifications are applied could be useful [Annalisa Cherchi, Italy]	rejected – no space to go into such detail
54556	40	37	40	40	Rasmussen et al., 2014 should be cited here - Colorado Headwaters and Climate Change J. Hydro Met. Also uses pseudo global warming approach [Linda Mearns, United States of America]	taken into account – given that space is limited, only a selection has been added.
56488	40	37	40	40	more recent studies include: changes in heavy precipitation over North America (Prein et al. 2017, Nature Clim. Change, 7 (1), 48-), origins of the Mediterranean Amplification (Kroner et al 2017, http://dx.doi.org/10.1007/s00382-016-3276-3; Brogli, et al. 2019, https://doi.org/10.1175/JCLI-D-18-0431.1), projections of European cloud cover (Hentgen et al. 2019. https://doi.org/10.1029/2018JD030150), changes in convective precipitation over Europe (Keller et al. 2019; Ban et al. 2019, Reconciling Conflicting Results on Intensification of Heavy Precipitation in a Changing Climate, submitted) [Christoph Schär, Switzerland]	taken into account – given that space is limited, only a selection has been added.
56524	40	37	40	40	It has also been used for the assessment of the changes in clouds over Europe in Hentgen et al., 2019. (For a reference, please see the previous comment.) [Nikolina Ban, Switzerland]	taken into account – given that space is limited, only a selection has been added.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50396	40	37	40	52	Other publcations: Liu et al. 2017: https://doi.org/10.1007/s00382-016-3327-9; Hentgen et al. 2019: https://doi.org/10.1029/2018JD030150; Sandvik et al. 2017: https://doi.org/10.1007/s00382-017-3593-1 ; Sørland et al. 2016: https://doi.org/10.1002/2015JD024658 [Silje Soerland, Switzerland]	taken into account – given that space is limited, only a selection has been added.
32176	40	40			Did you assess the use of PGW to better understand the drivers of the regional climate change pattern ? Very interesting usage to me. See for example Kröner et al. 2017 : Kröner, N., Kotlarski, S., Fischer, E., Lüthi, D., Zubler, E., & Schär, C. (2017). Separating climate change signals into thermodynamic, lapse-rate and circulation effects: theory and application to the European summer climate. Climate Dynamics, 48(9-10), 3425-3440. [Samuel Somot, France]	taken into account, including link to sensitivity studies section
51026	40	50	40	50	One may phrase this as a disadvantage, but it is not always the purpose of these event simulations. They are supportive as "weather storylines" in conveying the message of implications of climate change, along the lines of Hazeleger et al's "Tales of Future Weather" [Bart Van den Hurk, Netherlands]	taken into account – no longer phrased as disadvantage.
30014	40	50	40	52	Otto et al. (2016) is not a peer-reviewed publication and so should not be cited here. Also, to call this a "disadvantage" is a value judgement. Because every extreme event is by definition unique, the concept of occurrence probability is ill-defined, and can only be defined by generalizing to a class of extreme events, which has its own problems. The trade-offs between the approaches are indeed discussed in the Shepherd (2016) paper cited here. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	partly taken into account – the reference is relevant, but the term « disadvantage » is no longer used.
56490	40	50	40	52	This is not a disadvantage of the approach, but a problem of some applications. Many applications use 30-year-long or 10-year-long simulations (see page 40, lines 37-40, and additions provided above). The main disadvantage of the approach is that it neglects the high-frequency variations of climate change (but see Brogli et al 2019, cited above). [Christoph Schär, Switzerland]	taken into account. Text adjusted.
32178	40	52			What about mentioning the strong assumption (limitation) behind this kind of method that is to say the fact that synoptic scales (reanalysis) and the climate change (GCM) are independant and can be linearly added. [Samuel Somot, France]	accepted. A sentence has been added.
32180	41	5		14	If you need illustrations of such framework with RCMs, you can use Nabat et al. 2014 (twin runs with/without past aerosol trend over Europe). The ref is already cited in chap 10 [Samuel Somot, France]	Rejected: this section refers to control simulations with constant external forcing. The Nabat paper is about transient simulations where one removes the trend in aerosol forcing. These are different kind of simulations.
21006	41	27	41	32	Again, the use of acronyms is inconsistent. You need to define AMV and NAO just as you did for AMOC. [Gwenaelle GREMION, Canada]	Rejected: the NAO has already been introduced in the chapter
51028	41	49	41	49	Although I do agree with this conclusion about causality, the experimental design does not fully disentangle cause and effect: soil moisture/vegetation anomalies are partly caused by weather extremes. [Bart Van den Hurk, Netherlands]	Taken into account: the text has been revised for the SOD
30820	41	53	41	53	not sure you need this section 10.3.2.4, enough to refer to ch 3 [Annalisa Cherchi, Italy]	taken into account. The sub-section is needed because not everyone interested in regional aspects of climate will read chapter 3. It was shortened as much as possible and a reference to chapter 3 made.
48296	42	15	42	15	The section contents do not match the title and it is not clear what the purpose of the text is. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account (title modified)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
14430	42	23	42	31	If authors list papers to assess the skill of dynamical downsvaling, I recommend two papers (Sugimoto and Takahashi 2018 for the South Asia; Sugimoto et al. for East Asia; the detail of references are shown in other comment cells). [Shiori Sugimoto, Japan]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
14432	42	23	42	31	I recommend the paper of Sugimoto, S. and H. G. Takahashi (2016): Effect of Spatial Resolution and Cumulus Parameterization on Simulated Precipitation over South Asia. SOLA, 12A, 7-12, doi:10.2151/sola.12A-002. [Shiori Sugimoto, Japan]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
14434	42	23	42	31	I recommend the paper of Sugimoto, S., R. Ito, K. Dairaku, H. Kawase, H. Sasaki, S. Watanabe, Y. Okada, S. Kawazoe, T. Yamazaki, and T. Sasai (2018): Impact of Spatial Resolution on Simulated Consecutive Dry Days and Near-Surface Temperature over the Central Mountains in Japan. SOLA, 14, 46-51, doi:10.2151/sola.2018-008. [Shiori Sugimoto, Japan]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
29872	42	23	42	31	Please see the references for Central Asia and MENA domains: “Future Projections of Temperature and Precipitation Climatology for CORDEX-MENA Domain Using RegCM4.4”, Tugba Ozturk, M. Tufan Turp, Murat Türkeş, M. Levent Kurnaz, Atmospheric Research, Vol.206, 86-107 (2018). “Projected Changes in Temperature and Precipitation Climatology of Central Asia CORDEX Region 8 by Using RegCM4.3.5”, Tugba Ozturk, M. Tufan Turp, Murat Türkeş, M. Levent Kurnaz, Atmospheric Research, Vol.183, 296-307 (2017). [Mustafa Tufan Turp, Turkey]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
32182	42	25		31	Indeed the list of papers based on such evaluation runs is very very long over the assessed period. I m wondering how did you choose the list for every domain ? Are they really the most relevant examples of this literature ? For my region of interet (Euro-Mediterranean), I m not so sure. Did you choose a criteria of relevance in order to guide the readers towards the best examples ? [Samuel Somot, France]	Not applicable: text moved to the atlas
14100	42	27	42	27	Add a reference: "Hernández-Díaz et al., 2013; Panitz et al., 2014" -> "Hernández-Díaz et al., 2013; Kim et al., 2014; Panitz et al., 2014" [Jinwon Kim, Republic of Korea]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
42764	42	28	42	28	add reference Soares PMM, Careto JAM, Cardoso RM, Georgen K, Trigo RM (2019) Land-Atmosphere coupling regimes in a future climate in Africa: from model evaluation to projections based on CORDEX-Africa. In revision Journal of Geophysical Research. [Rita M Cardoso, Portugal]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48996	42	29	42	30	I would suggest to add the following reference when giving examples of downscaling evaluation simulations. Tencer et al (2016)'s work addressed the evaluation of several RCMs in reproducing compound precipitation and temperature extreme events in Southeastern South America. Tencer B, Bettolli ML, Rusitcucci M. 2016 Compound temperature and precipitation extreme events in Southern South America: associated atmospheric circulation and simulations by a multi-RCM ensemble. Climate Research 68: 183–199, doi 10.3354/cr01396. I also suggest to add the following reference for the downscaling evaluations. Menéndez et al (2009)'s work performed the evaluation of different RCMs and one statistical downscaling method in reproducing months with anomalous precipitation in Southeastern South America. Menéndez CG, de Castro M, Boulanger J-P, D'Onofrio A, Sanchez E, Sörensson AA, Blazquez J, Elizalde A, Jacob D, Le Treut H, Li ZX, Núñez MN, Pessacg N, Pfeiffer S, Rojas M, Rolla A, Samuelsson P, Solman SA, Teichmann C. 2009. Downscaling extreme month-long anomalies in southern South America. Climatic Change 98: 379-403. doi:10.1007/s10584-009-9739-3 [Maria Laura Bettolli, Argentina]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
30822	42	31	42	31	missing reference for North America? [Annalisa Cherchi, Italy]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
30824	42	33	42	36	a short assessment of the main results should be provided [Annalisa Cherchi, Italy]	rejected. The scope of this subsection is not to assess the performances of the methodologies (which is done later on and in the Atlas) but only to list the various methodologies.
49004	42	33	42	36	In line with the previous paragraph in this page (lines 23 to 31), it would be nice that the paragraph dedicated to statistical downscaling evaluations would have a similar structure. That is, to mention examples of evaluations of these methods in different regions of the world. I understand that the topic is difficult to summarize in a short paragraph due to the nature of statistical downscaling and to the lack of coordinated experiments at the moment, except for the VALUE experiment. But I think it would be of interest for the readers to have a picture of the different regions of the globe where the statistical downscaling simulations have been evaluated although not as a part of coordinated experiments. [Maria Laura Bettolli, Argentina]	rejected : the respective text for the dynamical downscaling has been moved to the Atlas (and references suggested to the Atlas), so there is no more need for a list of works evaluating statistical downscaling over the different regions of the world. The reader is referred to the Atlas.
46970	42	33	42	36	10.3.2.5 What was learnt? [Laura Gallardo, Chile]	rejected-The scope of this subsection is not to assess the performances of the methodologies (which is done later on and in the Atlas) but only to list the various methodologies.
54558	42	38	42	43	Perhaps also cite Dixon et al., 2016 here. [Linda Mearns, United States of America]	accepted
30826	42	38	42	43	not clear meaning of this paragraph [Annalisa Cherchi, Italy]	taken into account. Text revised.
32184	42	38			I think that the so-called Big-Brother/ittle-brother experiment may fit in this paragraph speaking about « perfect model » or « pseudo reality simulations ». See the whole literature by the Laprise's team in Canada for the North-America papers and for example Colin et al. (2010) for Europe (doi: 10.1111/j.1600-0870.2010.00467.x). [Samuel Somot, France]	accepted. The big brother experiment is discussed in Section 10.3.3.2

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48298	42	46	42	46	This section is very long and could be significantly shortened by focusing on the key assessment findings and their supporting literature (reads more like a review with afew key findings added). [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – has been shortened, but this section is key to the chapter.
7690	42	46	58	5	The part on the model performance could be summarized in a table with the different models (with may be their resolution) in rows and the large-scale phenomena and regional processes in columns. This could help any users to decide what type of model could be used depending on the analysis to perform. It will help the reader to understand more easily what bias is associated to the model selected . At the end of the reading reagrding the of model performance it is difficult to have a clear idea of what type of model is the best candidate for a particular topics. A table will also be complementary to Figure 10.1 [isabelle gouirand, Barbados]	rejected. Prose is needed to give detail, and there is no space for an additional table. Overlap with Chapter 11 has been reduced.
45532	42	46	64		The assessment of the performance of the different methods is very (too) detailed. A summary table that includes some kind of sinthesis of which phenomena is well/better represent by each method would be very useful. There may be some overlap with Chapter 11 (e.g, hurricanes) that should be discussed. [Di Luca Alejandro, Australia]	rejected. Prose is needed to give detail, and there is no space for an additional table. Overlap with Chapter 11 has been reduced.
57844	42	46			It is important to deepen these statistical approaches and disseminate them among specialists. [Gladys Linares-Fleites, Mexico]	noted – this is a trivial statement not calling for any action.
45530	42	48	42	48	"Assessing model performance is a prerequisite for projecting regional climate." Maybe rephrase by clarifying that it is a prerequisite if we want to characterise the confidence we have in those projections. Technically we can make projections without any evaluation... [Di Luca Alejandro, Australia]	accepted – text modified
30828	42	48	42	55	this is true also for global scale evaluation, refer to ch 3, there is no need to repeat [Annalisa Cherchi, Italy]	taken into account – has been rewritten.
41376	42				Section 10.3.3 What are the most important variables at a regional and local scale for risk/impact analysis and adaptation? Extremes, heat waves, trends in precipitation deficit, etc. This chapter could try to give a clear indication of how well different modelling methods do in representing these, and what the uncertainties are. So consider how WGII and III might benefit from the information in this chapter. In the different subsections on specific local weather phenomena it would also be valuable to add a comment on whether and how much each contributes toward events that are highly relevant for impact assessments. For example, do mountain winds contribute to local extreme rainfall or drought? Do coastal winds? Or fronts? Maybe address this a bit more in relation to the discussion on 'adequacy-for-purpose'. Also it would help to get an indication to what extent these local improvements by RCMs add up to improved predictions for GCMs, or is this not usually done? Ideally this information should feature strongly in the headline statements and ultimately in the SPM. It would also help if for each region of the world there was a clear indication as to which model produced the most realistic results, so that when people of that region want to look up climate projections, they know which model to trust most. Most of these questions are addressed in the text, so it will be helpful to extract the relevant bits of information from the text, possibly in the form of tables, and present it in a summarized form for easy access. Finally, what about the areas outside these selected study areas? Are they discussed elsewhere? [Debra Roberts, South Africa]	rejected– this comment calls for simple recipes which cannot be provided, as they are case specific. It goes beyond the chapter scope in requesting a climate assessment. The text already considers many phenomena relevant for regional climate change and impacts (10.3.3.5).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28162	43	19	43	23	Lee et al. (2019) introduced diagnostic metcs for amplitude of extra-tropical modes of variability, which I think could be a good additionoanl example. Lee, J., Sperber, K.R., Gleckler, P.J., Bonfils, C.J. and Taylor, K.E., 2019. Quantifying the agreement between observed and simulated extratropical modes of interannual variability. Climate Dynamics, 52(7-8), pp.4057-4089. [Jiwoo Lee, United States of America]	accepted
28164	43	19	43	23	Additional example for MJO: Ahn et al. (2017) Ahn, M.S., Kim, D., Sperber, K.R., Kang, I.S., Maloney, E., Waliser, D. and Hendon, H., 2017. MJO simulation in CMIP5 climate models: MJO skill metrics and process-oriented diagnosis. Climate dynamics, 49(11-12), pp.4023-4045. [Jiwoo Lee, United States of America]	accepted
6297	43	23	43	23	For front detection the Hope et al. (2014) reference is insufficient. Hope et al (2014) is a very regional studies that compares fronts over a limited region over Western Australia and only for one season, while there are other studies that compare different front methods gobally and over the oceans (where most fronts occure) and even for different seasons, for example Schemm et al. 2014 (doi: 10.1002/qj.2471). Further methods to identify specific meteorological phenomena exists and are not listed, for example, jet streams, warm conveyor belts or atmospheric blocks (see the summary study and Table 1 in Sprenger et al. 2017 (doi: 10.1175/BAMS-D-15-00299.1), which are all relevant. [Sebastian Schemm, Switzerland]	accepted
42770	43	27	43	27	add reference Careto et al. 2018 [Rita M Cardoso, Portugal]	accepted
21008	43	31	43	33	You state that there is a growing number of studies highlighting user-efined or user-relevant diagnostics but you only provide one citation. I think for this to stand, you need to provide several more examples. [Gwenaelle GREMION, Canada]	Accepted. The text has been adjusted.
30126	43	48			Such evaluation approaches studies are more costly and they are quite rare. However, they provide more insights for the interpretation of climate change information, hence I suggest to increase the number of such references, here. One study was condected by Reszler et al. (2018), who evaluated standards RCMs (from EURO-CORDEX initiative) and convection permitting models (CCLM and WRF) to capture flood generating precipitation events in the South Eastern forelands of the Alps in a multi-annual framework. The authors have demonstrated that it is not enough to capture only the amount of precipitation per event (which might be easier to be adjusted by some statistical methods), but also its temporal distribution on a subdaily scale. A situation that challenges existing dynamical and statistical downscaling methods. One could introduce this study here, for instance via "… in particular to evaluate convection permitting models for capturing flood generating precipitation events (Reszler et al., 2018), to evaluate the influence …" Reszler, C., Switanek, M. B. and Truhetz, H.(2018). Convection-permitting regional climate simulations for representing floods in small- and medium-sized catchments in the Eastern Alps. Nat. Hazards Earth Syst. Sci. 18(10), 2653–2674. doi: 10.5194/nhess-18-2653-2018. [Heimo Truhetz, Austria]	Accepted; a sentence has been added.
54888	44	11			The RCM added-value topic is also largely tackled in the Atlas chapter (section 5.6.2.4). Did you verify the consistency ? Any overlap ? [Samuel Somot, France]	Noted : Discussions with Atlas have resulted in text exchanges between Atlas and Ch. 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43158	44	13	45	18	Given the number of papers that address added value, this section seems very heavy on papers by Di Luca et al., and it would benefit from additional citations. Particularly where they back up the sentences with single citations. [Melissa Bukovsky, United States of America]	Rejected : Although Di Luca and collaborators have played a major role in exploring added value, several other authors are cited, as needed for the assessment (this is not a review).
28166	44	18	44	21	As further "example in complex or heterogeneous terrain such as mountains," I'd like to suggest considering to include Lee and Hong (2014), which is examining added value over the complex mountains in Korea. Lee, J.W. and Hong, S.Y., 2014. Potential for added value to downscaled climate extremes over Korea by increased resolution of a regional climate model. Theoretical and applied climatology, 117(3-4), pp.667-677. [Jiwoo Lee, United States of America]	accepted
54890	44	20			Concerning the added-value along the coastlines, did you assess Herrmann et al. 2011 : Herrmann M., Somot S., Calmanti S., Dubois C., Sevault F. (2011) Representation of daily wind speed spatial and temporal variability and intense wind events over the Mediterranean Sea using dynamical downscaling : impact of the regional climate model configuration. Nat. Hazards Earth Syst. Sci., 11, 1983-2001, doi:10.5194/nhess-11-1983-2011 [Samuel Somot, France]	accepted
21010	44	25	44	41	Possible merge these paragraph and shorten [Gwenaelle GREMION, Canada]	Rejected : The material is concise already.
54892	44	25		30	Perhaps good to specify that added-value is easier to obtain when RCMs or ESDs are forced by reanalysis (perfect boundary) than by free GCMs (unperfect boundary). [Samuel Somot, France]	Rejected : The key issue is whether or not an RCM can represent physical processes not resolved by a GCM.
30830	44	28	44	30	model improvement is a type of added value? This paragraph and the one above should be rephrased, not clear [Annalisa Cherchi, Italy]	Accepted. Removed discussion of "model improvement" which is a different matter, thereby keeping focus on added value as defined.
8972	44	38	44	38	For 'matching of probability distribution functions, you can add this reference, also using a different method to Soares and Cardoso, to show maps of model improvements in distribution against observations: Berthou, S., Kendon, E. J., Chan, S. C., Ban, N., Leutwyler, D., Schär, C., & Fosser, G. (2018). Pan-European climate at convection-permitting scale: a model intercomparison study. Climate Dynamics. https://doi.org/10.1007/s00382-018-4114-7 [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. This paper does not appear to be formally published. Climate Dynamics lists as First Online in March 2018, but the DOI supplied by the review is not valid. The DOI provided by Climate Dynamics itself is not found by Web of Science, and the paper does not appear in a list of publications by the author in this LA's university subscription to Climate Dynamics. Paper's lead author contacted, but no preprint appears available.
8974	44	39	44	39	field-significance tests of spatially distributed errors (Ivanov et al. 2017, 2018), you can also cite the Wilks paper on that very topic, whose method is used in Berthou et al. 2019, Kendon et al. 2019. Berthou, S., Rowell, D. P., Kendon, E. J., Rachel, R., Julia, S., & Catherine, C. (2019). Improved climatological precipitation characteristics over West Africa at convection-permitting scale. Clim. Dyn. https://doi.org/10.1007/s00382-019-04759-4 Kendon, E. J., Stratton, R. A., Tucker, S., Marsham, J. H., Berthou, S., Rowell, D. P., & Senior, C. A. (2019). Enhanced future changes in wet and dry extremes over Africa at convection-permitting scale. Nat. Comm. Wilks, D. S. (2016). "The Stippling Shows Statistically Significant Grid Points": How Research Results are Routinely Overstated and Overinterpreted, and What to Do about It. Bulletin of the American Meteorological Society, 97(12), 2263–2273. https://doi.org/10.1175/BAMS-D-15-00267.1 [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Accepted Wilks as an overview of the issue.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
14104	44	40	44	40	Add a reference after "Lenz et al., 2017;": "Lenz et al., 2017; Schaaf" -> Lenz et al., 2017; Kim et al. 2018; Schaaf" [Jinwon Kim, Republic of Korea]	Rejected : It is not clear what paper is Kim et al. (2018). Insufficient information provided.
54894	44	43		55	try to explain simply at the start of the paragraph, what is the basic principle of PAV. [Samuel Somot, France]	accepted
8976	45	11			adequate observational data may not be available to assess added value' (you could add the Berthou et al. 2018 reference, for the use of hourly gridded precipitation datasets,not availble throughout Europe. Berthou, S., Kendon, E. J., Chan, S. C., Ban, N., Leutwyler, D., Schär, C., & Fosser, G. (2018). Pan-European climate at convection-permitting scale: a model intercomparison study. Climate Dynamics. https://doi.org/10.1007/s00382-018-4114-7 [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account, same response as for ID 8972. This paper does not appear to be formally published. Climate Dynamics lists as First Online in March 2018, but the DOI supplied by the review is not valid. The DOI provided by Climate Dynamics itself is not found by Web of Science, and the paper does not appear in a list of publications by the author in this LA's university subscription to Climate Dynamics. Paper's lead author contacted, but no preprint appears available.
54896	45	18			I would expect here some conclusions about regions, seasons and specially phenomena for which the added-value of downscaling methods have been clearly shown (ex : extreme precip, regional winds) and those for which it is unclear (mean fields at large-scale, weather type, heat waves), … in order to inform more clearly the reader. It is what I'm expecting from a literature assessment concerning the added-value issue. [Samuel Somot, France]	Rejected : The intent of the section is to assess issues of concern when determining added value, not to give a review of all cases where it has been shown to occur or not to occur.
54898	45	18			In the editorial of the Med-CORDEX special issue in Climate Dynamics (Somot et al. 2018b), we have written an overview of the added-value articles for the Mediterranean area. You may be interested in looking at the section 4 of this editoral for recent literature about added-value: Somot S., Ruti P., Ahrens B., Coppola E., Jordà G., Sannino G., Solmon F. (2018b). Editorial for the Med-CORDEX special issue. Clim. Dyn. 51(3):771-777, doi: 10.1007/s00382-018-4325-x, https://link.springer.com/article/10.1007/s00382-018-4325-x [Samuel Somot, France]	Taken into account. Some papers described in the overview focus on specific phenomena, but they do not appear to be sufficiently multi-variate to cite as examples of multi-variate assessment of added value.
51032	45	32	45	33	Inter-model spread is also an expression of natural variability, not only of model-errors/model differences [Bart Van den Hurk, Netherlands]	Accepted. The sentence was changed to "This occurs due to the substantial variety in model biases, once natural variability is taken into account. Model biases largely dominate model performance".
41370	45	32			What exactly does this mean? [Debra Roberts, South Africa]	Accept. The sentence was changed to "In a multi-model context climate models show large differences in behaviour" and made an earlier reference to the new figure 10.5.
43160	45	33	45	35	This sentence is confusing. The last part of it is an incomplete thought… "In certain cases, systematic errors are common across a model class, performance metrics highlighting pervasive problems in the models." [Melissa Bukovsky, United States of America]	accepted.
54900	45	35			other good articles illustrating common biases in models (here RCMs) concerning representation of past trends : Lorentz and Jacob 2010 , Bartok et al. 2017 (already cited), both in multi-model framework. Lorenz, P., & Jacob, D. (2010). Climate Research, 44(2-3), 167-177. [Samuel Somot, France]	Taken into account, but the problem is not just for trends but for all sorts of biases.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
29618	45	42	45	42	The caption of Figure 10.5 is wrong. [Rodrigo Manzanas, Spain]	Accepted. The figure was and the caption adapted to the new version.
51034	45	44	45	52	Not really clear what you want to convey with this figure. That models diverge in their reconstruction of precipitation and temperature climatology? Would be good to make the message a bit more precise, for instance by comparing a regional performance to a global mean performance, or by a single model performance to a multimodel performance [Bart Van den Hurk, Netherlands]	Accepted. The figure was redrawn with results from experiments from all the main model types available together.
21012	46	20	46	20	I think "regional" here should be "spatial". [Gwenaelle GREMION, Canada]	Accepted. Regional was changed to spatial.
31364	46	20	46	20	What does "national" mean? Countries come i a huge variety of sizes, from Montenegro to Russia. Rather use kilometers? [Gerhard Krinner, France]	Accepted.
32490	46	31	46	39	Perhaps another relevant reference that describes regions where there are improvements and degradations with increasing resolution is Bacmeister et al 2014, J. Clim., 27, 3073-3099 [Isla Simpson, United States of America]	Accepted.
21014	46	32	46	33	I'm guessing you specifically mean forcing by atmospheric circulation. It may be important to specify. [Gwenaelle GREMION, Canada]	Accepted. Text revised and changed to “as in the case of the central European summer drought forcing by the atmospheric circulation”.
56064	46	34	46	34	Schiemann, R., M. E. Demory, L. C. Shaffrey, J. Strachana, P. L. Vidale, M. S. Mizielin- ski, M. J. Roberts, M. Matsueda, M. F. Wehner, T. Jung, and T. Jung (2017), The resolution sensitivity of Northern Hemisphere blocking in four 25-km atmospheric global circulation models, Journal of Climate, 30 (1), 337–358, doi:10.1175/JCLI-D- 16-0100.1. [Corti Susanna, Italy]	Accepted. Reference added.
56060	46	34	46	34	Dawson and Palmer 2015 is mainly about the benefit of stochasitc parameterisation on weather regimes. For the benefits of increased resolution for blocking Davini et al 2017 can be cited, 1. Davini P., S. Corti, F. D’Andrea, G. Riviere, J. von Hardenberg 2017, Improved winter European atmospheric blocking frequencies in high-resolution global climate simulations, J. Adv Model Earth Sy. 9, 2615–2634. https://doi.org/10.1002/2017MS001082. [Corti Susanna, Italy]	Accepted. Text revised and Dawson and Palmer substituted with Davini et al https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2017MS001082 in the list.
56062	46	34	46	34	Also Schiemann et al 2017 [Corti Susanna, Italy]	Accepted. Reference added.
21016	46	37	46	37	Change "it fails to solve the major dry bias" to "it fails to solve its major dry bias". [Gwenaelle GREMION, Canada]	Accepted . Text revised and used the suggested version of the sentence.
56058	46	38	46	38	stochastic parameterisations, not statistical [Corti Susanna, Italy]	Accepted. Text revised and statistical changed with stochastic. Dawson and Palmer (2015) added to the list.
31366	46	42	46	42	What are "future climate messages"? Can the text be a bit more clear on what can be believed and what not? [Gerhard Krinner, France]	Taken into account. GCMs are one of the tools available to produce climate messages of regional climate change (which will be better defined in section 10.1). However, what can be believed depends on the model, the physical problem, the agreement with other models, etc. and needs to be considered case by case.
51036	46	43	46	45	It is strange that robust confidence is given to a statement that in itself expresses a limitation to its scope. [Bart Van den Hurk, Netherlands]	Taken into account. The confidence statement is not about the biases but about the usefulness of the GMCs as a tool to create climate messages. The sentence has been modified to explain that useful information can be extracted from models with limitations.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7688	46	49	46	49	The term "strong gradients" could be clarified. Is gradient referring to the slope of a terrain? [isabelle gouirand, Barbados]	accepted (text revised)
41374	46				What exactly does this mean if predicted rainfall is for example 50mm? This is an important fact, and just needs to be spelled out plainly. [Debra Roberts, South Africa]	rejected – no general answer possible, depends on case.
8978	47	5			Is it worth adding the growing use of convection-permitting RCMs? CP-RCMs? As a sub-class of RCMs, it could be worth to say that ensembles at these resolutions are starting to be available (e.g. UKCP18 2.2km ensemble - Fosser et al. + UKCP18 report, CORDEX Flagship Pilot study, paper in preparation from Sobolowski et al., should be submitted by the end of the year). And many single model paper have been published (see Prein, A. F., Langhans, W., Fosser, G., Ferrone, A., Ban, N., Goergen, K., … Leung, R. (2015). A review on regional convection-permitting climate modeling: Demonstrations, prospects, and challenges. Reviews of Geophysics, 53(2), 323–361. https://doi.org/10.1002/2014RG000475, Kendon, E. J., Ban, N., Roberts, N. M., Fowler, H. J., Roberts, M. J., Chan, S. C., … Wilkinson, J. M. (2017). Do convection-permitting regional climate models improve projections of future precipitation change? Bull. Am. Meteorol. Soc., 98(1), 79–93. https://doi.org/10.1175/BAMS-D-15-0004.1 ; Fosser G, EJ Kendon, SC Chan, A Lock, NM Roberts, M Bush, “Optimal configuration and resolution for the first convection permitting ensemble of climate projections over the UK” submitted to Climate Dynamics, Kendon et al (2019) UKCP18 Convection-permitting model projections: Science report. Sept 2019, Available from https://www.metoffice.gov.uk/research/collaboration/ukcp/guidance-science-reports [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Noted ; convection permitting RCMs are discussed in 10.3.3.5.1
50398	47	6	47	6	What is meant by "diagnostic illustrating the total error of the GCM-RCM chain"? [Silje Soerland, Switzerland]	Accepted (text revised)
43268	47	20	48	38	Subsection 10.3.3.3.3 has small volume compared with very large number of articles for statistical downscaling, bias correction and weather generator. [Motoki Nishimori, Japan]	rejected –references have been added, but there is no space for further expanding the section.
38126	47	20	48	38	There are increasing downscalling studies using machine learning / artificial intelligence approach, should these be included and assessed ? [Daoyi Gong, China]	rejected – the Section has been shortened, there was no space to add such evaluation studies. Actually, several of the methods evaluated are calibrated by machine learning methods, so implicitly this is covered.
43266	47	20			The description in Subsection 10.3.3.3.3 tends to be too emphasized the results of the VALUE project. I would like to ask for a more balanced description. [Motoki Nishimori, Japan]	taken into account – more references have been added
57846	47	20			This topic is important and is treated exhaustively. [Gladys Linares-Fleites, Mexico]	accepted
31368	47	48	47	49	The last sentence might need a reference to back it up. [Gerhard Krinner, France]	accepted.
54610	47	51	47	54	What about models that combine linear regression with weather generators (e.g., SDSM)? This combo reuslts in fairly good reproduction of daily precip characteristics. [Linda Mearns, United States of America]	taken into account – this is exactly what is written here.
31370	47	51	47	54	The assessment in this paragraph does not seem to clearly arise from the material presented in the preceding paragraphs (e.g. no reference to gamma distribution papers) [Gerhard Krinner, France]	taken into account – text has been modified.
51038	47	52	47	54	single-site evaluations normally don't take spatial dependence into account, do they? [Bart Van den Hurk, Netherlands]	rejected – there is no statement about single-site evaluations.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43270	48	1	48	11	As you know, there are numerous numbers of literature for bias adjustment methods. I recommend you would refer below paper from the view point of intercomparison of methods for precipitation. Watanabe, S., S. Kanae, S. Seto, Pat J.-F. Yeh, Y. Hirabayashi and T. Oki (2012):Intercomparison of bias-correction methods for monthly temperature and precipitation simulated by multiple climate models. J. Geophys .Res., 117, D23114, doi:10.1029/2012JD018192. [Motoki Nishimori, Japan]	Rejected - the suggested paper is on modifications of the climate change signal and thus not relevant here. The tiny bit on evaluation is also not helpful as it does consider only some very rough diagnostics.
36654	48	1	48	38	There are a couple statements that the different BA methods are good at adjusting the things they intend to adjust, and that WG methods are good at the things they're calibrated for. Can we make any statements about how well/poorly they do on things they're NOT aiming for, or is there no literature on that? (I.e., are there aspects that "come along for the ride" when applying these methods to other aspects?) If not, it may be worth suggesting that as an area of possible future research. [Seth McGinnis, United States of America]	taken into account – implicitly already there, has been emphasised by reordering and adjusting the text.
43272	48	36	48	38	This sentence has mostly similar meaning of adjacent paragraph, so it is unnecessary. [Motoki Nishimori, Japan]	rejected– this sentence is a summarising assessment statement.
48074	48	41	48	41	There may be some overlap between Section 10.3.3.4 (Performance at simulating large-scale phenomena and teleconnections relevant for regional climate) and Chapter 3, in which the assessment of model performance in simulating ENSO characteristics (including ENSO spatial pattern, frequency, asymmetry between warm and cold events, and diversity) is discussed. [WGI TSU, France]	Taken into account: the text has been revised to minimize overlap with chapter 3
48076	48	41	48	41	There may be some overlap between Section 10.3.4.4 (Designing and using ensembles for regional climate change assessments) and Box 4.1 (Ensemble evaluation and weighting). [WGI TSU, France]	Taken into account: the text has been revised to minimize overlap with the chapter 4 box
32492	48	47	48	48	I find this to be a rather sweeping statement that makes standard resolution GCMs sound pretty bad, without really backing up what it's referring to. There are many aspects of the large scale circulation that are represented well with standard resolution GCMs. I think if a statement like this is going to be made, it needs to be backed up with specific examples of what it's referring to. There certainly are some e.g., a common equatorward bias in the SH jet stream, blocking issues etc. But I think this should be stated specifically as opposed to a sweeping statement about all aspects of the large scale phenomena. [Isla Simpson, United States of America]	Accepted: the text has been revised for the SOD
36656	48	51	48	51	Self-reference to Section 10.3.3.4 in Section 10.3.3.4 should be removed. [Seth McGinnis, United States of America]	Accepted: the text has been revised for the SOD
51040	48	51	48	51	cross-reference is made to the very same section [Bart Van den Hurk, Netherlands]	Accepted: the text has been revised for the SOD
21018	48	52	48	53	This sentence could retale to chapter 10.3.3.5 or 10.3.3.8 [Gwenaelle GREMION, Canada]	Accepted: the text has been revised for the SOD
31372	48	53	48	53	"Also RCMs..." - a somewhat awkward sentence with a slightly unclear message. Can you reformulate? [Gerhard Krinner, France]	Accepted: the text has been revised for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21020	49	1	49	21	The paragraph provides examples of the performance of CMIP5 models in representing Blocking only in the Northern Hemisphere. For an assessment of the performance of models in the Southern Hemisphere a reference to consider is Parsons, S., J.A. Renwick, and A.J. McDonald, 2016: An Assessment of Future Southern Hemisphere Blocking Using CMIP5 Projections from Four GCMs. J. Climate, 29, 7599–7611, https://doi.org/10.1175/JCLI-D-15-0754.1 In particular that article mentions that the GCM historical run presents a that ltr distribution as seen in the reanalysis. However, the Blocking Episodes (BE) frequency is slightly reduced in the mean of the four model runs compared to hat derived from ERA-I. The GCM historical BEs also extend farther into the Indian Ocean and South Atlantic Ocean than the reanalysis. The GCM historical ensemble seasonal BE frequencies are again similar to the reanalysis with the highest frequency of BEs occurring during winter. However, in the GCM historical output the band of BEs between extends farther east in winter. [Gwenaelle GREMION, Canada]	Taken into account: references have been added and the text has been revised for the SOD.
54902	49	1		21	Concerning CMIP5 weather regimes representation incl. Bloacking : Cattiaux et al. 2013 : Cattiaux, J., Douville, H., & Peings, Y. (2013). European temperatures in CMIP5: origins of present-day biases and future uncertainties. Climate dynamics, 41(11-12), 2889-2907. [Samuel Somot, France]	Taken into account: the reference has been added for the SOD.
54904	49	1		21	Concerning RCM representation of weather regimes (to confront/complement the Jury et al. 2018), an already old paper but still relevant (mutli-model framework) : Sanchez-Gomez et al. 2009a : Sanchez-Gomez E., Somot S., Déqué M. (2009a) Ability of an ensemble of regional climate models to reproduce the weather regimes during the period 1961-2000. Clim. Dyn., 33(5):723-736, doi:10.1007/s00382-008-0502-7 [Samuel Somot, France]	Taken into account: the reference has been added and the text revised for the SOD.
54906	49	1		21	I think that McSweeney et al. 2015 (already cited later) deserves a good place in this section. [Samuel Somot, France]	Rejected: not clear why this reference should fit here. This paper proposes a general method to select GCMs for dynamical downscaling by focusing on temperature and precipitation.
56066	49	6	49	7	These are 4 weather regimes. No longitudinal distribution of blocking frequency. If you want to refer to the improvement of blocking in CMIP5 you can refer to Davini and D'Andrea 2016 [Corti Susanna, Italy]	Not Applicable: a new figure has being redrawn for the SOD
21022	49	11	49	13	I suggest to either include refference for this affirmation or link better with the folowing sentence [Gwenaelle GREMION, Canada]	Taken into account: the reference has been added and the text revised for the SOD.
31374	49	14	49	14	Maybe worth citing or looking at work on Greenland blocking (Hanna, Fettweis) [Gerhard Krinner, France]	Taken into account: the reference has been added and the text revised for the SOD.
49242	49	16	49	16	A reference for blocking and resolution would be the multi-model study of Schiemann et al. (2016). R. Schiemann, M.-E. Demory, L. C. Shaffrey, J. Strachan, P. L. Vidale, M. S. Mizielinski, M. J. Roberts, M. Matsueda, M. F. Wehner, T. Jung, 2016: The resolution sensitivity of Northern Hemisphere blocking in four 25-km atmospheric global circulation models. Journal of Climate, doi: https://doi.org/10.1175/JCLI-D-16-0100.1. [Malcolm Roberts, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the reference has been added and the text revised for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21024	49	34	49	43	The paragraph provides examples of the performance of CMIP5 models in representing Storm Tracks only in the Northern Hemisphere. For an assessment of the performance of models in the Southern Hemisphere a reference to consider is: Chang, E. K. M., Guo, Y., and Xia, X. (2012), CMIP5 multimodel ensemble projection of storm track change under global warming, J. Geophys. Res., 117, D23118, doi:10.1029/2012JD018578. "In the upper troposphere (300 hPa), most models simulate storm tracks that are weaker than that found in ERA-Interim data, consistent with CMIP3 results [Chang et al., 2012]. In the mid-to-lower troposphere (700 hPa) and at sea level, the ensemble mean storm track in the NH has similar amplitude as that found in ERA-Interim, but the model-mean in the SH is still weaker. There is a large spread in storm track intensity among the models, with the weakest model storm tracks having peak intensities of around 60% of that of the strongest ones.Chang et al. [2012]suggested that these amplitude biases could, in part, be related to model biases in their simulation of mid-tropospheric temperature gradients, which might be related to the findings byTrenberth and Fasullo [2010] that coupled models seem to have problems getting the correct radiative inputs and therefore baroclinicity over the Southern Ocean due to biases in cloud simulations. In addition to the amplitude bias, most models display an equatorward bias in the latitude of storm tracks, especially in the SH. The corresponding climatology for JJA is shown in the left panels of Figure 3. In the NH summer, nearly all models simulate a weaker storm track than that found in ERA-Interim, while the amplitude bias in the SH is not as large percentagewise. Again, most storm tracks show an equatorward bias, especially in the SH lower troposphere. " [Gwenaelle GREMION, Canada]	Taken into account: the reference has been added and the text revised for the SOD.
32494	49	42	49	43	Is this statement about interannual variability coming from Yang et al (2018) as well? If so, I think some re-wording would be helpful to make that clear. If not, then I think a reference is needed for this statement. [Isla Simpson, United States of America]	Accepted: the text has been revised for the SOD
30016	49	45	49	49	This is not a balanced discussion. There is far more literature showing the impact of the representation of topography on storm-track biases than there is for the processes discussed here. Two such recent references are Pithan et al. (2016 GRL, already in your reference list) and van Niekerk et al. (2017 JAS doi: 10.1175/JAS-D-17-0085.1). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the text has been revised and references have been added for the SOD
42772	49	51	49	54	"If run over large domains, reanalysis-driven RCMs can, for specific regions, significantly improve the representation of storm characteristics compared to the driving reanalysis near areas with marked orography and regions with large water masses (Poan et al., 2018)." This is not necessarily true. If the domain is large enough, the RCM's internal variability will control the atmospheric circulation and the RCM will not improve the storm characteristics (Potoppidan et al. 2019) Pontoppidan,M., Kolstad E.W., Sobolowski, S. P., Liu, C., & Rasmussen, R. Largescale model biases in the extratropical North Atlantic storm track and impacts on downstream precipitation [Rita M Cardoso, Portugal]	Accepted: the text has been revised and references have been added for the SOD
51042	49	56	50	3	the explanation of the contrast between sea and land in RCM-performance to reproduce Mediterranean storms is not very clear [Bart Van den Hurk, Netherlands]	Noted: text has been removed as there is no explanation in the Flaounas paper of these results
48402	50	20			Seasons like winter and summer should be referenced as boreal or austral [Rondrotiana Barimalala, South Africa]	Accepted: the text has been revised for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32496	50	26	50	28	Where is this statement about the ability of CMIP5 models to capture the response coming from? Its it also from Hurwitz et al? If so, that could be made clearer. Also, Butler and Polvani (2011) GRL, 38, L13807 argue that SSWs occur more frequently in both El Nino and La Nina. It seems like there is some confusion over what the response to La Nina actually is, although maybe it depends on whether you're referring to mean changes or changes in extremes. [Isla Simpson, United States of America]	Taken into account: the text has been revised by making clear that the statement comes from the same paper. The paper only talks about the mean seasonal response, not the SSW. So the last part of the comment does not apply. I have also added text and one reference (added to Mendeley) related to teleconnection to the Southern Hemisphere, also from the same paper.
48404	50	38	50	52	This part seems off topic. I suggest focusing on ENSO teleconnection only or change the title of the subsection to be tropical SST teleconnection [Rondrotiana Barimalala, South Africa]	Not applicable: the text has been removed
51044	50	40	50	40	Which eastern equatorial region? Of the ENSO domain? [Bart Van den Hurk, Netherlands]	Not applicable: the text has been removed
6291	51	10	51	10	convection is embedded along weather fronts, which form in tandem with extratropical cyclone development (Schemm et al. 2018 doi: 10.1175/bams-d-16-0261.1), and convection is forming inside the rising air, i.e. the warm conveyor belt, of an extratropical cyclone's warm sector (Browning 1986 doi: 10.1175/1520-0434(1986)001<0023:CMOPS>2.0.CO;2 or Browning 1990; Browning, K. A., 1990: Organization of clouds and precipitation in extratropical cyclones. Extratropical Cyclones: The Erik Palmén Memorial Volume, C. W. Newton and E. O. Holopainen, Eds., Amer. Meteor. Soc., 129–153, are relevant references). [Sebastian Schemm, Switzerland]	Rejected: we are not talking here about convection in extra-tropical cyclones but only about MJO teleconnections.
21026	51	28	51	28	The introductory paragraph of this section could follow 10.3.3.9.1 (p.60, l.16-21) style, including the relation it has to other chapters of the AR6 and introducing AR5 and post-AR5 findings [Gwenaelle GREMION, Canada]	taken into account – has been rewritten.
21028	51	31	51	32	Regional/mesoscale/large-scale are used ambiguously. I would refer to one term to ensure consistency [Gwenaelle GREMION, Canada]	taken into account. We use mesoscale and regional interchangeably, but refer to mesoscale only for weather phenomena. Similarly, we use large-scale synonymously with synoptic scale (and larger). We will continue to improve the text after the SOD.
21030	51	31	51	32	To make it more compact, maybe this sentence could be rewriten in these lines "These, modulate the influence of larger weather phenomenas, ultimatelly creating weather regional characteristics and potentially severing tehir conditions" [Gwenaelle GREMION, Canada]	taken into account – partly rewritten
21032	51	34	51	35	To make it more compact, I would replace "climate change information for a given region and application" by "regional climate information" [Gwenaelle GREMION, Canada]	rejected – required to highlight the dependence on region and application.
48406	51	40	51	47	Should this paragraph fit better in 10.3.3.3.3 where overall performance of different types of models is assessed? The title of this section seems to be more on performance in processes than performance of a model. [Rondrotiana Barimalala, South Africa]	rejected – we discuss performance of models in simulating processes.
43162	51	40	51	47	It is not clear why this paragraph is here. It does not directly relate to the paragraph above it, or subsections below it, or this section introduction. [Melissa Bukovsky, United States of America]	taken into account – has been moved behind all dynamical model issues.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
36658	51	46	51	47	I'm not sure what "could even inflate well-represented sensitivities" means. Should it be "exaggerate" instead of "inflate"? [Seth McGinnis, United States of America]	taken into account – rephrased.
51046	51	47	51	47	Is "inflate" similar to "deteriorate"? [Bart Van den Hurk, Netherlands]	taken into account – rephrased.
51482	52	3	53	8	Lee cyclogenesis should not only be discussed in terms of surface pressure fields but consider also the formation of cut-off lows at 500 or 300 hPa. Typically, the most intense events exhibit this feature. (Awan, N.K. & Formayer, H. Theor Appl Climatol (2017) 129: 149. https://doi.org/10.1007/s00704-016-1767-0) [Petra Seibert, Austria]	not applicable, text has been deleted
8212	52	6	52	6	The Prein2015 review also highlights that paramtrised convective models tend to underestimate the occurance of extreme rain rates [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	noted. We prefer to cite the original literature rather than a review though. The Prein review has been cited anyway in several places already.
8238	52	9	52	9	In case you feel it of interest, I have recently published east africa specific results on the diurnal cycle of convection and orographically forced convection https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-18-0387.1 [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – has been added for improvement of diurnal cycle and issues with land breezes.
39424	52	9	52	14	Resolution-dependency and convective parameterization are very important issues here. The following can be helpful. Ref. Sugimoto, S., and H.G. Takahashi, 2016: Effect of Spatial Resolution and Cumulus Parameterization on Simulated Precipitation over South Asia. SOLA (Scientific Online Letters on the Atmosphere), 12A, 7-12, doi:10.2151/sola.12A-002. [Hiroshi Takahashi, Japan]	rejected - the paper is very speculative in its conclusions and does not provide conclusive results.
56526	52	9	52	14	It also improves the simulation of local scale wind systems (Belušić et al., 2018). [Belušić, A., Prtenjak, M.T., Güttler, I. et al. Near-surface wind variability over the broader Adriatic region: insights from an ensemble of regional climate models. Clim Dyn (2018) 50: 4455. https://doi.org/10.1007/s00382-017-3885-5] [Nikolina Ban, Switzerland]	rejected – not relevant here, see below (ID 48408)
48408	52	9	52	20	An other reference worth to add here could be the Stratton et al., 2018 and some of the linked papers (https://doi.org/10.1175/JCLI-D-17-0503.1) , a Pan-African Convection-Permitting Regional Climate Simulation with the Met Office UM (CP4-Africa), which shows an improved rainfall biases over different parts of Africa) [Rondrotiana Barimalala, South Africa]	rejected – not relevant here, as specifically on phenomena, not overall performance.
21034	52	9	52	20	Deep convention is over-represented in comparison to shallow convection, which is not discussed [Gwenaelle GREMION, Canada]	noted. The research focus is on deep convection though.
54908	52	9		20	A recent paper (Fumière et al. 2019, Climate Dyn) also shows the improvment of CPRCM for daily and hourly extreme precipitation around the Mediterranean area during the Fall season that is to say when and where the extremes are the strongest in Europe. Fumière Q., Déqué M., Nuissier O., Somot S., Alias A., Caillaud C., Laurantin O., Seity Y. (2019) Extreme rainfall in Mediterranean France during autumn: added-value of the AROME-Climate Convection-Permitting Regional Climate Model. Clim. Dyn (should be accepted when you read these lines) [Samuel Somot, France]	taken into account.
54910	52	9		21	The CPRCM capcities have been largely discussed in the Atlas chapter too. Duplication ? [Samuel Somot, France]	noted – we don't see the discussion of model performance in simulating processes as a key element of the Atlas. Redundancies should be reduced in the Atlas.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8980	52	11			improvement in the diurnal cycle of convection also shown in Berthou, S., Kendon, E. J., Chan, S. C., Ban, N., Leutwyler, D., Schär, C., & Fosser, G. (2018). Pan-European climate at convection-permitting scale: a model intercomparison study. Climate Dynamics. https://doi.org/10.1007/s00382-018-4114-7 [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – considered
8240	52	17	52	17	MCSs in africa have recently also been investigated https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EA000491 [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	taken into account
8982	52	18	52	18	Statistics of organized convective lifecycles in West Africa are largely improved by using convection-permitting models (Crook, J., Klein, C., Folwell, S., Taylor, Christopher M. Parker, D. J., & Stein, T. (2019). Assessment of the Representation of West African Storm Lifecycles in Convection-Permitting Simulations. J. Climate.) [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	taken into account (same as above)
14554	52	19	52	20	Specify what the convection permitting resolution is, e.g. "kilometer-scale grid spacing" (Kendon et al. 2017). [Stefan Fronzek, Finland]	accepted
51478	52	32	52	40	Realistic simulation of thermal circulations over mountainous terrain requires that valleys and slopes are explicitly resolved; and the model topography should have an area-height distribution similar to the real one. For the Alps, 4 km grid spacing is clearly inadequate; it has been shown that 1 km is a reasonable starting point. See (ZÄNGL, G., 2004: A reexamination of the valley wind system in the Alpine Inn Valley with numerical simulations. Meteorol. Atmos. Phys. 87, 4, 241–256, dx.doi.org/10.1007/s00703-003-0056-5, Arnold, D., et al. (2012): Issues in high-resolution atmospheric modeling in complex topography - The HiRCoT workshop, Croatian Meteorological Journal, 47, 3-11. http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=171360., P. Seibert and R. Steinacker (2016): Thermische Windsysteme über alpiner Topografie. Promet: meteorologische Fortbildung, 98, S. 25-42; ISSN 0340-4552. [Petra Seibert, Austria]	taken into account – considered, but only peer reviewed literature
52298	52	33	52	33	Commas missing in "localised, thermally generated, diurnal circulations". [Sergio Henrique Faria, Spain]	Editorial -- once accepted, the draft will undergo professional copy-editing
21036	52	36	52	36	A reference might be included for this affirmation [Gwenaelle GREMION, Canada]	rejected– no reference required for basic text book knowledge.
51480	52	42	52	45	There is vast body of lterature related to modelling foehn in the Alps which should be taken into account. The required resolution very much depends on the actual terrain, but also on the features one wishes to reproduce. If one aims at the broad features of flow over a ridge and situation in the foothills, the resolution of hydrostatic waves can be sufficient and a 4 km grid spacing may be proper. However, if the entering of foehn winds into single valleys is to be simulated, or if the along-slope topography is irregular so that the general foehn wind is superimposed to gap flows, obviously much higher resolution is needed. At this scale, nonhydrostatic waves, rotors, wave breaking etc. become important. Also note that foehn is not necessarily associated with upstream precipitation. [Petra Seibert, Austria]	noted. We would be happy to include a few specific suggestions if space permits.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
42774	52	45	52	45	A precipitation spectral analysis for the Norwegian mountain ranges indicates that at least 3km resolution is necessary to correctly represent orographic precipitation in Norway (Potoppidan et al. 2017) Pontoppidan, M., Reuder, J., Mayer, S., & Kolstad, E. W. (2017). Downscaling an intense precipitation event in complex terrain: the importance of high grid resolution, Tellus A: Dynamic Meteorology and Oceanography, 69(1), 1271561. doi: 10.1080/16000870.2016.1271561. [Rita M Cardoso, Portugal]	rejected – not relevant here.
54912	52	48			Another well-known wind called etesian or meltem over the Aegean Sea : Dafka, S., Toreti, A., Luterbacher, J., Zanis, P., Tyrlis, E., & Xoplaki, E. (2017). On the ability of RCMs to capture the circulation pattern of Etesians. Climate dynamics, 1-20. [Samuel Somot, France]	taken into account – but added in coastal wind section.
54914	52	48			For the Bora : Belušić, A., Prtenjak, M. T., Güttler, I., Ban, N., Leutwyler, D., & Schär, C. (2018). Near-surface wind variability over the broader Adriatic region: insights from an ensemble of regional climate models. Climate dynamics, 50(11-12), 4455-4480. [Samuel Somot, France]	taken into account – reference added
54916	52	48			More generally for the winds over the Med Sea (Herrmann et al. 2011) : Herrmann M., Somot S., Calmanti S., Dubois C., Sevault F. (2011) Representation of daily wind speed spatial and temporal variability and intense wind events over the Mediterranean Sea using dynamical downscaling : impact of the regional climate model configuration. Nat. Hazards Earth Syst. Sci., 11, 1983-2001, doi:10.5194/nhess-11-1983-2011 [Samuel Somot, France]	rejected – the focus here is on specific wind systems.
21038	52	50	52	52	To ensure consistency, model resolution units could be in km instead of degrees [Gwenaelle GREMION, Canada]	taken into account. Using km for GCM grids is not useful, therefore we decided to use degrees instead. Only for very high resolutions we use km.
48866	53	4		8	The area(s) where storms are originated is not so well defined. It covers a large zone of the northwestern Mediterranean. However, it should be more properly called Gulf of Genoa (not Gulf of Lyon), which is the usual denomination for this cyclogenesis area among meteorologists and where the peak of the cyclogenesis frequency is located (see figures 2 of https://doi.org/10.3402/tellusa.v68.29391) [piero lionello, Italy]	not applicable, text has been deleted
51484	53	10	53	11	I would say it is “virtually certain” that finer resolution is necessary. It is trivial - how should a model resolve processes occurring at the below-km scale if it does not have below-km resolution? Note that, as correctly stated in the introductory sentence of the subsection, all these circulations are driven by slope winds and thus it is this feature that needs to be resolved. [Petra Seibert, Austria]	taken into account – but not in likelihood language, only in confidence language
51486	53	10	53	11	I would prefer “thermally driven circulations over mountainous / complex topography” to “mountain breezes”. The latter term is not widely used and not clear enough. Alternatively, one could explicitly refer to slope and valley winds / circulations. [Petra Seibert, Austria]	taken into account – rewritten.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39426	53	14	53	47	Using a 4-km RCM, detailed water vapor transport with a regional H20 green-house effect can be shown over Tokyo, Japan. This coastal effect should be cited here. Ref. Takahashi, H.G., S.A. Adachi, T. Sato, M. Hara, X. Ma, and F. Kimura, 2015: An Oceanic Impact of the Kuroshio on Surface Air Temperature on the Pacific Coast of Japan in Summer: Regional H2O Greenhouse Gas Effect. J. Climate, 28, 7128-7144, doi:10.1175/jcli-d-14-00763.1. Adachi S.A, F. Kimura, H.G Takahashi, M. Hara, X. Ma, and H. Tomita, 2016: Impact of high-resolution sea surface temperature and urban data on estimations of surface air temperature in a regional climate. J. Geophys. Res., 121, 10,486-410,504, doi:10.1002/2016JD024961. [Hiroshi Takahashi, Japan]	rejected – the first study is about climate change experiments, the second focusses on urban climate.
21040	53	14	54	6	This section could be re-structured as follows: (1)coastal winds in lines 20-22, (2)sea breeze in lines 24-35, (3) downwind climate in lakes in lines 37-44, lines 15-18, overall assessment statement in lines 46-47, (4) lake regions in lines 49-1(+1), (5) overall assessment statement in lines 3-6(+1) [Gwenaelle GREMION, Canada]	rejected– we prefer staying in the current structure and also keep separate assessment statements.
21042	53	14	54	6	Maybe other coastal phenomenons such as boundary layer processes can be added [Gwenaelle GREMION, Canada]	rejected– the section length had to be reduced anyway, so no space to include further phenomena.
21044	53	17	53	18	Maybe something could be added on lake climates [Gwenaelle GREMION, Canada]	rejected– section length had to be reduced, no space for additions.
52300	53	20	53	22	Hyphen is missing in "0.44ºresolution", whereas the hyphen should be DELETED from "10-m wind speed", because it is grammatically wrong to insert a hyphen between a value and its unit (cf. NIST and BIPM recommendations for SI writing). [Sergio Henrique Faria, Spain]	accepted
21046	53	20	53	30	To ensuer consistency, model resolution units could be in km instead of degrees [Gwenaelle GREMION, Canada]	taken into account. Using km for GCM grids is not useful, therefore we decided to use degrees instead. Only for very high resolutions we use km.
8214	53	37	53	37	"during winter". This is statement should clarify that it is referring to the mid-latitudes. There are many large lakes in the tropics (e.g. lake maracaibo, lake victoria) where the term "winter" is not relevant. [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	rejected – in the Tropics, the whole point does not apply.
32498	53	39	53	39	I'm not sure that the statement that low surface friction accelerates the air is correct. Friction is always going to decelerate the air, it's more that the are is not decelerated as much over the lakes. Suggest re-wording. [Isla Simpson, United States of America]	accepted – text adjusted
21048	53	49	53	53	This sentence could be dived into a first one introducing lake regions, and a second one stating the importance of including these systems in RCMs [Gwenaelle GREMION, Canada]	taken into account – text rewritten.
39428	53	49	54	6	It not a lake effects, convections can be observed over the Sea of Japan, which is very similar to the Great Lakes. Over the Sea of Japan, impact of SST on snowfall is very important. A high-resolution simulation permitted us to detailed discussion on the impact of SST. Ref. Takahashi, H.G., N. N. Ishizaki, H. Kawase, M. Hara, T. Yoshikane, X. Ma, and F. Kimura, 2013: Potential impact of sea surface temperature on winter precipitation over the Japan Sea side of Japan: A regional climate modeling study. J. Meteor. Soc. Japan Ser. II, 91, 471-488, doi:10.2151/jmsj.2013-404. [Hiroshi Takahashi, Japan]	rejected– the paper is about process understanding, not model performance.
43164	53	51	53	51	With no comma, this sentence suggests that the US, Canada, and central Asia all share a border. [Melissa Bukovsky, United States of America]	accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43166	53	51	53	53	Please consider adding Spero and Notle 2015 (https://doi.org/10.1175/JCLI-D-15-0233.1) to this citation list. It shows how not using a lake model, and instead using WRF's default lake temperature specification, can lead to biases hundreds of kilometers away form the US Great Lakes. [Melissa Bukovsky, United States of America]	accepted
6293	54	9	54	29	First sentence of the paragraph needs proper citation. For example, the linkage between hail and cold fronts was shown by Schemm et al. (10.1002/asl.660). [Sebastian Schemm, Switzerland]	taken into account, reference added.
21050	54	10	54	11	Please consider mentioning the South America Low Level Jet which also brings moinsture from the Amazonia regions to extratropical regions such South Eastern South America. Vera, Carolina & Báez, Julián & Douglas, Michael & Emmanuel, CB & Marengo, Jose & Meitin, J & Nicolini, Matilde & Nogues-Paegle, J & Paegle, J & Penalba, Olga & Salio, Paola & Saulo, A & Dias, Maria & Silva Dias, Pedro & Zipser, Edward. (2006). The South American Low-Level Jet Experiment. Bulletin of the American Meteorological Society. 87. 63-78. 10.1175/BAMS-87-1-63. [Gwenaelle GREMION, Canada]	rejected – the paper describes a field campaign. The (very short) part on model performance addresses a specific MCS occurring within the LLJ, but not the simulation of the LLJ in general.
30134	54	10			Fronts are 3 dimensional not two dimensional surfaces. [Heimo Truhetz, Austria]	rejected – space is 3D, the front is 2D.
6295	54	29	54	29	Here it should be mentioned that there is a certain degree of freedom of how to define a front (see broad historic overview and discussion in Schemm et al. 2018 doi: 10.1175/bams-d-16-0261.1) and that studies exist that compare different method and use more than one method to make their findings more robust (Schemm et al. 2014 doi: 10.1002/qj.2471) [Sebastian Schemm, Switzerland]	rejected - the text is on performance in representing fronts, not about frontal detection.
30136	54	29			Another study, conducted by Piazza et al. (Meteorol. Z., in press), has evaluated precipitation in convection permitting models in the European Alpine region and found that seasonal precipitation biases can be attributed to frontal activity to amounts from 40% to 90% (30% to 70%) in winter (summer). Piazza, M., Prein, A. F., Truhetz, H., Csaki, A. (in press). On the sensitivity of precipitation in convection-permitting climate simulations in the Eastern Alpine region. Meteorol. Z. [Heimo Truhetz, Austria]	rejected– the study is too speculative on the deviation.
21052	54	31	54	31	Maybe an overall assessment of GCMs and RCMs including fronts with a medium evidence of their realistic performance can be added [Gwenaelle GREMION, Canada]	rejected – we believe there is too little evidence yet to come up with an assessment statement.
43168	54	34	54	34	Unless there is intent to add discussion of land-based low-level jets to this section, I suggest adding the word "coastal" to the section name. However, a brief discussion of over-land LLJs would be an appropriate addition. [Melissa Bukovsky, United States of America]	taken into account – due to space constraints, the assessment was limited to CLLJs and merged into the coastal and lake effects subsection.
8216	54	34	54	51	This section seems to have quite a general title, not encompassed by the content. I recommend either changing the title to "coastal low-level jets" or including description of other low-level jets. Importantly the Turkana jet and the Somali jets of Eastern Africa are very important for the climate of the region. Both these jets are a key transport of moisture onto the African continent (contrary to your statement). See Nicholson2015 for turkana jet https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.4515 and fig16 of Yang 2015 to see moisture transport which is largely due to Somali low level jet https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.4515 [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – due to space constraints, the assessment was limited to CLLJs and merged into the coastal and lake effects subsection.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21054	54	34	54	51	All low-level jets here discussed are related to the coast. Maybe the text could be moved into Coastal effects section, and this section could address other regional effects of jet streams, if models exist for these [Gwenaelle GREMION, Canada]	taken into account – due to space constraints, the assessment was limited to CLLJs and merged into the coastal and lake effects subsection.
51690	54	35	54	36	Coastal low-level jets occur in several regions and are not limited to summer events or to cold equatorward eastern boundary currents of the major oceans. The text should be rewritten. In the next comment there is a more accurate description of eastern boundary current systems low-level jets. An in a second comment there are several references of other coastal and inland low-level jets [Rita M Cardoso, Portugal]	taken into account – due to space constraints, the assessment was limited to CLLJs and merged into the coastal and lake effects subsection.
51692	54	35	54	48	The summer coastal low-level jets in the mid-latitude western continental coasts are forced by the eastern branch of the semi-permanent ocean anticyclones which drive equatorward coastal parallel winds, an inland thermal low, a strong cross-shore thermal contrast associated to the oceanic upwelling and high coastal topography. These low-level jets are a common feature along the California (Burk, S. D., and W. T. Thompson, 1996; Winant et al. 1988; Parish 2000), Peru-Chile (Garreaud and Muñoz 2005; Muñoz and Garreaud 2005), western Australia (Stensrud 1996), Benguela (Nicholson 2010; Patricola et al. 2017), North Africa (Soares et al. 2018) and Iberian (Soares et al. 2014) coasts. A similar jet also occurs in the southeast Arabian Peninsula coast, but it develops within the South Asia monsoon, forcing a coastal-parallel flow along Yemen and Oman (Ranjha et al. 2015). These jets also occur in spring and autumn but with lower frequency (Lima et al. 2018). These jets are important in the onshore moisture transport and in the strength of the upwelling systems in the most productive fisheries regions. Reanalysis and most GCMs are not able to characterise all the details of coastal low-level jets (Bukovsky et al., 2013), however they are still able to represent annual and diurnal cycles and interannual variability (Lima et al. 2018, Semedo et al. 2016). According to Semedo et al. (2016) the most significant impacts of climate change will off the coast of Iberia and Oman. An increase in frequency of occurrence and a higher jet core was found for all regions. Dynamical downscaling of ERA-Interim reanalysis (Soares et al. 2014; Cardoso et al. 2016; Patricola et al. 2017) and GCMs historical runs (Soares et al. 2018; Lima et al. 2018; Bukovsky et al., 2013) display realistic jet structure and surface winds are comparable to observational datasets. These results highlight the influence of coastal capes in the dynamics of coastal low-level jets. A good representation of the coastline is needed in order to correctly represent the climate change signal, since the strongest signals are associated to the protruding capes (Soares et al. 2017, 2018; Lima et al. 2019). Additionally to the future higher jet core and higher frequency of occurrence during summer, the Eastern Atlantic jets will occur more frequently during winter, spring and autumn, will also	noted – most of the suggested literature is about region by region studies and future changes, but this section is on model performance. Still, the description of the phenomenon and two references have been taken into account.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51694	54	35	54	48	references for low-level jets over land: Campetella, C. M., and C. S. Vera, 2002: The influence of the Andes mountains on the South American low-level flow. Geophys. Res. Lett., 29, 1826, https://doi.org/10.1029/2002GL015451. Nuñez, M.N., Solman, S.A. & Cabré, M.F. Regional climate change experiments over southern South America. II: Climate change scenarios in the late twenty-first century. Clim Dyn (2009) 32: 1081. https://doi.org/10.1007/s00382-008-0449-8 J.C. Labraga, R. Villalba (2009) Climate in the Monte Desert: Past trends, present conditions, and future projections. Journal of Arid Environments, 73, 154-163. https://doi.org/10.1016/j.jaridenv.2008.03.016. K.H. Cook, E.K. Vizy, Z.S. Launer, et al. Springtime intensification of the Great Plains low-level jet and Midwest precipitation in GCM simulations of the twenty-first century J. Clim., 21 (2008), pp. 6321-6340 X. Jiang, N.-C. Lau, I.M. Held, J.J. Ploshay Mechanisms of the Great Plains low-level jet as simulated in an AGCM J. Atmos. Sci., 64 (2007), pp. 532-547 Ying Tang, Julie Winkler, Shiyuan Zhong, Xindi Bian, Dana Doubler, Lejiang Yu and Claudia Walters, Future changes in the climatology of the Great Plains low-level jet derived from fine resolution multi-model simulations, Scientific Reports, 10.1038/s41598-017-05135-0, 7, 1, (2017) Shou, Y.-X., Wang, J., Lu, F., Yue, C., Shou, S. (2018)Ensemble simulations of a northerly low-level jet in the INFLUX field experiment Atmospheric Research, 213, 361-369 https://doi.org/10.1016/j.atmosres.2018.06.018 Patricola, C.M. & Cook, K.H. (2011) Sub-Saharan Northern African climate at the end of the twenty-first century: forcing factors and climate change processes. Clim Dyn, 37, pp 1165–1188 https://doi.org/10.1007/s00382-010-0907-y Wang, D., Zhang, Y. & Huang, A. Asia-Pacific J Atmos Sci (2013) 49: 259. https://doi.org/10.1007/s13143-013-0025-y references of low level jets in other coastal areas: Martin MR; Schumacher C (2011) The Caribbean Low-Level Jet and Its Relationship with Precipitation in IPCC AR4 Models. Journal of Climate, 24, 5935-5950	noted – most of the suggested literature is about region by region studies and future changes, but this section is on model performance. Still, the description of the phenomenon and two references have been taken into account.
14108	54	39	54	39	Add a reference after "Bukovsky et al., 2013": "Bukovsky et al., 2013" -> 'Bukovsky et al., 2013; Kim et al., 2005' [Jinwon Kim, Republic of Korea]	rejected – reference not given.
14112	54	42	54	42	Add before Bukovsky et al. (2013): "Kim et al. (2005) showed that an RCM simulation at 60 km horizontal resolutions can represent the turning of low-level northwesterlies over the Baja California into southwesterlies over the Sea of Cortez (Gulf of California), a key low-level wind structure associated with rainfall in northwestern Mexico and southwestern United States during NAMS, that is absent in the driving reanalysis data." [Jinwon Kim, Republic of Korea]	rejected – reference not given.
9528	55	4	55	6	Variability of atmospheric rives has also been linked to drought occurrences. The absence of atmospheric rivers-driven-precipitation has been associated with reduced snowpacks and drought periods in California (See: Guan et al., 2013, Dettinger& Cayan, 201) as well as global low flows in various locations (See: Paltan et al 2017) [Paltan Homero, United Kingdom (of Great Britain and Northern Ireland)]	not applicable – text has been removed
21056	55	6	55	18	GCMs seem over-represented in comparison to RGMs, which are not discussed [Gwenaelle GREMION, Canada]	not applicable – text has been removed
14114	55	8	55	8	Add reference: 'Nardi et al.," -> "Kim et al., 2013, 2018; Nardi et al.,' [Jinwon Kim, Republic of Korea]	rejected – reference not given.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46444	55	9	55	13	Kamae et al. (2019) examined projection of the landfalling atmospheric river in the East Asia by varying the SST pattern, and demonstrated the increase of the landfalling risk under global warming and its dependence on the SST pattern. The sensitivity of the future projection to the SST pattern may vary with geographical locations. Kamae, Y., W. Mei, and S.-P. Xie, 2019: Ocean warming pattern effects on future changes in East Asian atmospheric rivers. Env. Res. Lett., 14, 054019, doi:10.1088/1748-9326/ab128a. [Tomoe Nasuno, Japan]	not applicable – text has been removed
21058	55	10	55	10	Please consider including this reference where the relationship between atmospheric river and extrem events are mentioned. This paper is for southern South America Reference for atmospheric river and extreme events in SA: Viale, M., R. Valenzuela, R.D. Garreaud, and F.M. Ralph, 2018: Impacts of Atmospheric Rivers on Precipitation in Southern South America. J. Hydrometeor., 19, 1671–1687, https://doi.org/10.1175/JHM-D-18-0006.1 [Gwenaelle GREMION, Canada]	not applicable – text has been removed
50806	55	11	55	16	Please consider adding doi: 10.1029/2018MS001326, which discusses variable resolution modeling of mountain hydroclimatology (from 55, 28, 14, to 7 km) and the distinct roles of grid spacing and microphysics modelng in the abilty to improve precipitation performance of CESM. [Chaincy Kuo, United States of America]	not applicable – text has been removed
48410	55	24	55	49	For tropical cyclones, I suggest to include the effects of both resolution and air-sea coupling. Here are some e.g. recent references on resolutions: Kim et al., 2018 (https://doi.org/10.1175/JCLI-D-17-0269.1) ; Li and Sriver, 2018 (https://doi.org/10.1002/2017MS001199) ; Lengaigne et al., 2018 (Influence of air–sea coupling on Indian Ocean tropical cyclones, Clim Dyn. 52, 577-598) [Rondrotiana Barimalala, South Africa]	not applicable – text has been removed
46446	55	24	55	49	It is recommended to refer that reports are also given in 11.7.1 (pages 60-66 of Chapter 11), including the improved reproducibility of the intense TCs (e.g., category 4 and 5) in GCMs and results of TC projection with 1-10 km mesh sizes (structure change under global warming). [Tomoe Nasuno, Japan]	not applicable – text has been removed
21060	55	25	55	25	Short descriptions for the other terms under 10.3.3.5. were very useful. One could also be added here [Gwenaelle GREMION, Canada]	not applicable – text has been removed
49244	55	33	55	33	PRIMAVERA-HighResMIP have a manuscript in prep (Roberts et al.) to compare tropical cyclone performance over 6 atmosphere only models with resolution. [Malcolm Roberts, United Kingdom (of Great Britain and Northern Ireland)]	not applicable – text has been removed
45264	56	5	56	5	The following sentence is supposed to be added to the end of line 5 on page 6-56 (i.e, "..to cool the climate."): ", which highly depends on the vertical altitudes where the aerosol species reside (Li et al., 2017) " Reference: Li, Z., J. Guo, A. Ding, H. Liao, J. Liu, Y. Sun, T. Wang, H. Xue, H. Zhang, B. Zhu, 2017. Aerosol and boundary-layer interactions and impact on air quality, National Science Review, 4 (6), 810–833. doi: 10.1093/nsr/nwx117. [Jianping Guo, China]	not applicable – this comment seems to refer to another chapter

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21062	56	8	56	10	Other regional land feedback mechanisms are related biomass-erosion by wind (e.g. Dupont et al 2013: https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1002/2013JF002875) and water (e.g. Panagos et al 2015: https://www.sciencedirect.com/science/article/pii/S1462901115300654#fig0010) [Gwenaelle GREMION, Canada]	rejected– no space to add further feedbacks
21064	56	8	56	10	Other regional land-atmosphere feedback mechanisms are related to GHG-biomass through SOC or GHG-permafrost (e.g. Schuur et al 2015: https://www.nature.com/articles/nature14338) [Gwenaelle GREMION, Canada]	rejected– no space to add further feedbacks
54918	56	8			I would add aerosol coupling, very relevant at regional scales [Samuel Somot, France]	see response to comment #54938
21066	56	14	56	27	The effect of vegetation on albedo could be also considered (e.g. Brovkin et al 2013: https://doi.org/10.1029/2012MS000169 / Shen et al 2015: https://www.pnas.org/content/112/30/9299.short) [Gwenaelle GREMION, Canada]	rejected– no space to add further feedbacks
21068	56	29	56	30	The assessment could reffer to the medium evidence of the statement [Gwenaelle GREMION, Canada]	taken into account (medium confidence)
21070	56	33	56	55	I find it difficult to understand the soil-moisture temperature feedback (m-temp) without discussing it together with the soil-moisture precipitation feedback (m-precip). Maybe the paragraph about the m-precip can be placed before the m-temp one, so the second can be discussed in light of the first, making it more understandable why the strength of the coupling between m-temp varies so strongly. [Gwenaelle GREMION, Canada]	rejected – we follow the « classical » order as in the review by Seneviratn et al., 2010, also because the soil-moisture precipitation coupling is so much more complex.
21072	56	34	56	36	The effect of evapotranspiration enhancing local precipitation due to available moisture is here not mentioned. [Gwenaelle GREMION, Canada]	noted – there is in general very limited literature on model performance, but the effect is implicitly addressed in the studies cited.
6796	56	45	56	55	While in GCMs and RCMs mostly the local land-atmosphere climate interactions are focused on, results of a statistical downscaling study for Europe by Hertig et al. 2018 suggest that also larger-scale teleconnections are of importance. Teleconnections between preceding soil moisture anomalies and subsequent precipitation occur, with modifications of the large-scale atmospheric circulation and humidity playing an important role. In this regard the statistical modeling results diverge from the classical conceptual framework with local dependency of evaporation on soil moisture, which is commonly used to understand soil moisture-precipitation relationships. Reference: Hertig, E., Tramblay, Y., Romberg, K., Kaspar-Ott, I., Merkenschlager, Ch. (2018): The impact of soil moisture on precipitation downscaling in the Euro-Mediterranean area. Climate Dynamics. DOI: 10.1007/s00382-018-4304-2 [Elke Hertig, Germany]	rejected- not relevant here, paragraph discusses model performance.
14436	56	47	56	50	Sugimoto and Takahashi (2017) and Takahashi and Polcher (2019) might be suitable for the reference, which investigates the sensitivity of preciptation intensity and frequency on the land surface wetness in South Asia and Southeastern Asia; Sugimoto, S. and H. G. Takahashi (2017): Seasonal differences in precipitation sensitivity to soil moisture in Bangladesh and surrounding regions. J. Climate, 30, 921-938, DOI: 10.1175/JCLI-D-15-0800.1; Takahashi, H. G., and J. Polcher, 2019: Weakening of rainfall intensity on wet soils over the wet Asian monsoon region using a high-resolution regional climate model. Progress in Earth and Planetary Science, 6, 26, doi:10.1186/s40645-019-0272-3. [Shiori Sugimoto, Japan]	rejected- not relevant here, paragraph discusses model performance.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48412	57	7	57	19	It would be good to have an assessment sentence on the ocean-atmosphere coupling. [Rondrotiana Barimalala, South Africa]	taken into account – has been added
54920	57	7		17	Coupled atmosphere-ocean RCM can also show good representation of regional ocean phenomena such as open-sea deep convection influenced by strong air-sea fluxes here in the North-Western Mediterranean Sea (Somot et al. 2018) : Somot S., Houpert L., Sevault F., Testor P., Bosse A., Taupier-Letage I., Bouin M.N., Waldman R., Cassou C., Sanchez-Gomez E., Durrieu de Madron X., Adloff F., P. Nabat, Herrmann M. (2018a) Characterizing, modelling and understanding the climate variability of the deep water formation in the North-Western Mediterranean Sea. Climate Dynamics, 51(3), 1179-1210, doi: 10.1007/s00382-016-3295-0 [Samuel Somot, France]	rejected – oceans (without direct relevance for land climate) will not be covered in Chapter 10.
54922	57	7		17	Gaertner et al. 2018 shows an improvement in the seasonality of medicanes using coupled RCM : Gaertner M.A., Gonzalez-Aleman J.J., Romera R., Dominguez M., Gil V., Sanchez E., Gallardo C., Miglietta M.M., Walsh K., Sein D., Somot S., dell'Aquila A., Ahrens B., Colette A., Bastin S., van Meijgaard E., Nikulin G. (2018) Simulation of medicanes over the Mediterranean Sea in a regional climate model ensemble: impact of ocean-atmosphere coupling and increased resolution. Climate Dynamics, 51(3), 1041-1057, doi: 10.1007/s00382-016-3456-1 [Samuel Somot, France]	taken into account – reference added
21074	57	17	57	17	If I understood correctly, according to this paragraph there is high agreement and robust evidence that RCMs can simulate well ocean-atmosphere feedbacks. This could be reflected in an asessment statement [Gwenaelle GREMION, Canada]	taken into account – has been added
54924	57	18			what about adding a paragraph here about the aerosol-climate coupling that can help to improve regional climate representation even if it is to say that we have very few articles on this topics currently. You can assess at least : Nabat et al. 2014 (already cited), 2015a (already cited), 2015b (doi:10.5194/acp-15-3303-2015), Gutierrez et al. 2018 (https://doi.org/10.1016/j.solener.2018.09.085), Drugé et al. 2019 (https://doi.org/10.5194/acp-19-3707-2019) + some studies by Zubler at ETHZ [Samuel Somot, France]	rejected – given the limited space available and the lack of literature, we decided not to include this topic even though it is of course relevant.
21076	57	21	57	21	An opening paragraph could be added introducing the different subsections and referring to the advancements post-AR5, which are exposed in this section [Gwenaelle GREMION, Canada]	Not applicable. This section has been shortened for the SOD.
21078	57	22	57	22	Land use change could also be included together with Land management and Urban climate and urbanism (e.g. Schneck et al 2015: https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1002/2014GB004959 / Perugini et al 2017: https://iopscience.iop.org/article/10.1088/1748-9326/aa6b3f/meta) [Gwenaelle GREMION, Canada]	Rejected (Schneck et al 2015) : this paper does not treat the subject of 10.3.3.7 (assessment of the performance of climate models in simulating regional anthropogenic drivers of climate and climate change). Rejected (Perugini et al 2017) due to space limits
48916	57	22	57	45	This section discusses land management w.r.t. performance in simulating regional anthropogenic drivers of climate and climate change. The topical subjects are irrigation and tillage practices. There is possibly room to bring up anthropogenic aerosols by referencing 6.4.2.2. [Chaincy Kuo, United States of America]	Noted. Dust and anthropogenic aerosols is now treated in this section, as well as in Section 10.1.4 and 10.3.1 and references have been added to Chapter 6 when appropriate.
21080	57	24	57	35	Other possible modelled land management practices together with their effects on the climate are Reforestation/forest clearance, Livestock & manure associated to GHGs: http://www.fao.org/gleam/en/, Mulching [Gwenaelle GREMION, Canada]	Rejected. In this section we assess how the performance in simulating regional climate is affected by including land management processes in land surface models that are coupled with the atmosphere. The model mentioned by the reviewer is not coupled to a climate model.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
13968	57	29	57	30	"precipitation, in particular over the South Asian monsoon region, where irrigation is most intense in the world amounting to around 0.5 mm/day on a yearly basis (McDermid et al., 2017), linkages between soil moisture and the Tibetan Plateau monsoon (Zhou et al., 2019). The inclusion of " [Jun Wen, China]	Rejected. Although the reviewer has not specified which paper Zhou et al., 2019 (s)he is referring to, we guess that it is the https://doi.org/10.1002/joc.5723. This paper treats the impact of spring soil moisture on the Tibetan Plateau monsoon using reanalysis. This is clearly out of the scope for the present section where we assess how the performance in simulating regional climate is affected by including land management processes in coupled land surface - atmosphere models.
8224	57	47	57	47	The following paper reviews urban heat island and climate change research and could be a useful addition to this section. https://link.springer.com/article/10.1007/s10980-017-0561-4 [Declan Finney, United Kingdom (of Great Britain and Northern Ireland)]	not applicable – text has been moved to box and shortened
48918	57	47	58	4	This section discusses urban climate and urbanisation w.r.t. performance in simulating regional anthropogenic drivers of climate and climate change. The topical subjects are urban heat islands. There is possibly room to reference 6.4.2.4 for impacts of short-lived climate forcers from megacities on the climate. [Chaincy Kuo, United States of America]	not applicable – text has been moved to box and shortened
54926	57	47			Daniel et al. 2019 shows that a given RCM coupled with a urban model is better to represent UHI than without for Paris (doi:10.1007/s00382-018-4289-x) [Samuel Somot, France]	Taken into account. Text moved to the urban box.
32500	58	2	58	4	This is very far from my area of expertise, but I find this statement to be lacking in evidence. I think the evidence that a simple single-layer parameterization is sufficient needs to be discussed (sorry if I'm missing it somewhere) and I also think it needs to be clarified what this is referring to. Perhaps it is referring to simulating the influence of urban regions on climate. I would imagine there are many other uses of urban climate modelling e.g., to understand the impact of changing aspects of buildings or to model the dispersion of pollutants through street canyons etc. Again, not my area so I don't have concrete examples, but I think the evidence needs to be provided for this statement and I think it needs to be clarified what specifically this is referring to. [Isla Simpson, United States of America]	not applicable – text has been moved to box and shortened
26220	58	4	58	4	I do not think that evidence is shown here on this statement "a simple single-layer parameterization is sufficient for urban climate modelling". [Akio Kitoh, Japan]	not applicable – text has been moved to box and shortened
30128	58	4			Please add references to demonstrate this robust evidence. [Heimo Truhetz, Austria]	not applicable – text has been moved to box and shortened
21082	58	7	58	7	Are there studies on dry and continental areas that might be added? [Gwenaelle GREMION, Canada]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
48300	58	7	58	7	Much of the material in this subsection overlaps a lot with the Atlas regional assessments so perhaps is not needed (see related comments on specific sub-sections of this section below. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
35378	58	10	58	13	Recitation of reference used in Atlas (Page Atlas-49, Line 10 and 13). Sabin et al., 2013 is cited in Chapter 10, page 58, line 25. [Mehwish Ramzan, Pakistan]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
21084	58	14	58	14	Maybe some studies can be also add about South and Central America and the Caribean monsoons [Gwenaelle GREMION, Canada]	Not applicable – Section 10.3.3.8 no longer included in the chapter.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48414	58	14	58	34	As you still need to revise this section, it would be nice to start with a global monsoon sentence for the tropical climate before going into details with the South Asian and West African monsoons [Rondrotiana Barimalala, South Africa]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
26222	58	18	58	22	SST bias in the Indian Ocean (and other oceans also), particularly in the Arabian Sea, is crucial in simulating the South Asian monsoon rainfall. For example: Sandeep, S., and R. S. Ajayamohan, 2014: Origin of cold bias over the Arabian Sea in climate models. Scientific Reporrts, 4, 6403. [Akio Kitoh, Japan]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
21086	58	36	58	38	If it is the case, maybe this could be referred to the SE of N America, E Australia and African and Asian regions with this type of climate with a couple of references, and then proceed to the two examples [Gwenaelle GREMION, Canada]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
48998	58	36	59	2	The paragraph is somehow contradictory about the ability of GCMs in representing seasonal precipitation in SESA. This could probably be related with the fact that, although SESA is a region characterized by an increment in summer precipitation as a whole, it combines different precipitation regimes. Seasonal precipitation cycles change gradually from east to west (from 45°W to 65°W, which are the limits considered for this report) with a southwest-northeast accumulated precipitation gradient. Therefore, depending on the specific sector of SESA where the evaluation of the GCMs is performed, GCMs ability may be different (which is also an important reason for developing and improving downscaling over the region). Different authors found that GCMs tend to represent a dry summer bias over the region (Silvestri and Vera, 2008; Bettolli and Penalba, 2014; Maenza et al. 2017; Falco et al. 2018) in line with the results of Solman (2016). If the attention is focused on the sector of SESA where this happens, it tends to be more accentuated towards the south and west of SESA. In the northern and eastern parts of SESA, GCMs tend to show slight positive biases in summer precipitation as it can be seen in the results from Vera and Silvestri (2008), Falco et al (2018) and Solman (2016). It is also important to mention that the different biases found could be also related with the uncertainties introduced by the differences in the observational datasets used to evaluate the GCMs' performances. For the SESA region, these differences could be very large. I would suggest to clarify these points in the paragraph and to add the references cited: Silvestri G, Vera C. 2008. Evaluation of the WCRP-CMIP3 model simulations in the La Plata Basin. Meteorol. Appl. 15: 497–502. Maenza R, Agosta Scarel EA, Bettolli ML. 2017. Climate change and precipitation variability over the western "Pampas" in Argentina. International Journal of Climatology 37: 445–463. doi: 10.1002/joc.5014 Bettolli M.L., Penalba O. 2014. Synoptic sea level pressure patterns-daily rainfall relationship over the Argentine Pampas in a multi-model simulation. Meteorological	Not applicable – Section 10.3.3.8 no longer included in the chapter.
32502	58	37	58	39	I don't see any basis for this statement in terms of references or evidence from the following text. I think that should be provided. [Isla Simpson, United States of America]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
39642	58	48	48	50	Diaz and Vera (2017) evaluated the performance of 33 CMIP5 models and show a dry bias of summer precipitation in SESA. Moreover, models display in general summer precipitation variability weaker than observed. [Carolina Vera, Argentina]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
48630	58	48	59	2	The discussion on SESA regiona (10.3.3.8.2) is overlapping with Atlas South America subsection [Lincoln Alves, Brazil]	Not applicable – Section 10.3.3.8 no longer included in the chapter.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
49000	58	55	59	2	It is not clear what the authors mean when they say “this warm bias” in line 2 of page 59 [Maria Laura Bettolli, Argentina]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
49312	58		60		Do paleoclimate simulations provide insights about model performance in simulating regional climates that could be added to section 10.3.3.8? For example, what do Pliocene and Last Interglacial (relatively proximal past warm climates) inter-model and data-model comparisons tell us about models’ abilities to simulate Arctic temperatures in warmer climates? What do paleoclimate proxy data suggest about the magnitude of Arctic feedbacks? [Yarrow Axford, United States of America]	rejected – throughout the Section we consider only recent climate.
32504	59	2	59	2	What warm bias is this referring to? I don’t see any mention of a warm bias in the previous test. Should this be “a warm bias” as opposed to “this warm bias”? [Isla Simpson, United States of America]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
8278	59	5	59	21	Please add some information such as Yao Y., J.B. Huang, Y. Luo and Z.C. Zhao, 2016, Improving the WRF model’s simulation over sea ice surface through coupling with a complex thermodynamic sea ice model, Geosci. Model Dev., doi:10.5194/gmdd-8-10305-2015 [Zong Ci Zhao, China]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
31376	59	5	59	21	The authors are aware that this section (10.3.3.8, and thus also 10.3.3.8.3) needs revision, and I agree. The selection of topics here is a bit surprising. Important topics that could be assessed are polar cloiuds, inversion strengths, possibly circumpolar westerlies and their interaction with sea ice (SH). You might want to distinguish GCMs and RCMs. Do you want to say something about polar precipitation (ice sheet surface mass balance)? [Gerhard Krinner, France]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
21088	59	6	59	10	Sea-ice feedback could be moved to section 10.3.3.10 [Gwenaelle GREMION, Canada]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
52302	59	19	59	19	the hyphen should be DELETED from "2-m air temperature", because it is grammatically wrong to insert a hyphen between a value and its unit (cf. NIST and BIPM recommendations for SI writing). [Sergio Henrique Faria, Spain]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
54930	59	24			A general comment is that what is called « Mediterranean climate » is limited to climate over land. What about ocean climate or ocean climate phenomena such as regional ocean winds (Belusic et al. 2018, Obermann et al. 2018), associated strong air-sea fluxes (Somot et al. 2018), ocean deep convection (Somot et al. 2018) or Marine heat waves (Darmaraki et al. 2019). For me, they are also part of the phenomena that, RCMs should be able to represent. In general in chap 10 regional ocean at climate scale is miss-treated. This is likely true for all the other regions. Is it a choice ? Or a bias in the author list ? Darmaraki S., Somot S., Sevault F., Nabat P., Cabos W., Cavicchia L., Djurdjevic V., Li L., Sannino G., Sein D. (2019) Future evolution of Marine Heat Waves in the Mediterranean Sea. Climate Dynamics, DOI: 10.1007/s00382-019-04661-z [Samuel Somot, France]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
32506	59	25	59	27	I’m not sure it’s accurate to say that the Mediterranean climate is characterized by strong winds and heave precipitation. At least this is not the first thing that comes to mind in terms of characteristics of Mediterranean climate. Rather it is that they are characterized by temperate, wet winters, and warm dry summers. For example, I suspect that further north in Europe is characterized by stronger winds and heavier precipitation? Suggest some re-wording. [Isla Simpson, United States of America]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
32508	59	25	59	38	Zappa et al (2014), J. Clim., 26, 5850-5862 have discussed the simulation of Mediterranean cyclones in global models. Perhaps this is relevant? [Isla Simpson, United States of America]	Not applicable – Section 10.3.3.8 no longer included in the chapter.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48868	59	25			This is not the definition of Mediterranean climate according to Koeppen climate types, according to which it is characterized by dry summers and mild, wet winters. In spite of this intese phenomena such as heavy precipitation,cyclones and strong winds occur in the Mediterranean region (e.g. https://doi.org/10.1016/B978-0-12-416042-2.00012-4) [piero lionello, Italy]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
54928	59	26			Concerning extreme precipitation as represented in RCMs, I would cite Fantini et al. 2018 (already cited), Ruti et al. 2016 (already cited) and Fumière et al. 2019 (Fumière Q., Déqué M., Nuissier O., Somot S., Alias A., Caillaud C., Laurantin O., Seity Y. (2019) Extreme rainfall in Mediterranean France during autumn: added-value of the AROME-Climate Convection-Permitting Regional Climate Model. Clim. Dyn (in revision) [Samuel Somot, France]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
8984	59	31			climatology of heavy precipitation events in autumn in the Mediterranean improved with convection-permitting models (Berthou et al. 2018 Clim. Dyn (see reference above), Fumière et al. Extreme rainfall in Mediterranean France during the fall: added value of the CNRM-AROME convection-permitting regional climate model. Clim. Dyn. (under review)) [Ségolène Berthou, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
48870	59	35			I think some citation is needed here e.g. https://doi.org/10.1016/B978-0-12-416042-2.00008-2 [piero lionello, Italy]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
15382	59	41	60	1	The simulation of extream weather events for mountains can be taken from CLIMATE CHANGE ANALYSIS AND PROJECTIONS FOR THE RUSSIAN PART OF THE ALTAI-SAYAN ECOREGION AND KAZAKHSTAN AND MONGOLIA FRONTIERS. – MOSCOW: WWF-RUSSIA, 2018. https://wwf.ru/en/resources/publications/booklets/analiz-i-prognoz-izmeneniy-klimata-v-rossiyskoy-chasti-altae-sayanskogo-ekoregiona-i-na-prigranichny/ [Oksana Lipka, Russian Federation]	Not applicable – Section 10.3.3.8 no longer included in the chapter.
48302	60	4	60	4	This subsection overlaps a lot with the Atlas which needs to be resolved in the SOD. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – has been discussed with Atlas. Here the focus is on processes and forcings, the Atlas focusses on a region-by-region assessment.
21090	60	8	60	8	Consider replace the word “forecast” by “source” [Gwenaelle GREMION, Canada]	rejected– this is a statement by AR5.
51052	60	9	60	11	Statement sounds obvious: strong regional trend simulated because models have a strong climate response. Or do you imply a link of global mean climate sensitivity and (scattered) regions with extreme trends? [Bart Van den Hurk, Netherlands]	not applicable, text has been deleted
32512	60	10	60	10	This sentence makes it sound like we can rule out this high climate response. If this is referring to high climate sensitivity, it doesn’t seem like we can rule out high sensitivity climate models as being correct. I suspect there will be a lot of discussion of this in other parts of the report anyway. If this is fair, then I suggest re-wording. [Isla Simpson, United States of America]	not applicable, text has been deleted
32510	60	10	60	10	“response” → “sensitivity” ? [Isla Simpson, United States of America]	not applicable, text has been deleted
21092	60	23	60	23	That statement needs a reference (like Hawkins and Sutton, 2009) [Gwenaelle GREMION, Canada]	taken into account –reference to the corresponding section has been added.
41378	60	29			Just state what “latter” is. The text is too complex to remember. [Debra Roberts, South Africa]	accepted
32514	60	41	60	47	Since multiple large ensembles are now available from different models, perhaps it would be worthwhile making a statement that we now have the capabilities to do this form of analysis for a variety of models? [Isla Simpson, United States of America]	not applicable. The text has been shortened.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
50400	60	50	60	50	other reference: Bartók et al. 2016: https://doi.org/10.1007/s00382-016-3471-2 [Silje Soerland, Switzerland]	rejected – this study is not about historical trends.
43172	60	50	60	54	There is another I know is in review you might consider adding at some point, since studies along these lines are limited: Cavazos Et al 2019, IJOC: Intercomparison of regional climate models and climatic trends in the CORDEX-CAM (Central America, Caribbean and Mexico) domain. [Melissa Bukovsky, United States of America]	taken into account – has been added.
54932	60	50			Concerning representation of trends in RCMs, I recommend to assess also : Lorenz and Jacob (2010), Nabat et al. 2014 (already cited), Bartok et al. 2017 (already cited), Gutierrez et al. 2018 (https://doi.org/10.1016/j.solener.2018.09.085). For Lorenz, P., & Jacob, D. (2010). Validation of temperature trends in the ENSEMBLES regional climate model runs driven by ERA40. Climate Research, 44(2-3), 167-177. [Samuel Somot, France]	noted – but Lorenz et al. Is pre-AR5, Bartok et al. Is about future projections and Gutierrez et al. About solar energy production, the small trend aspect overlaps strongly with the Nabat study, which is now considered here.
54934	60	50			Concerning the trend in coupled RCMs (latent heat flux, SST, shortwave above the sea), see also Sevault et al. (2104) : Sevault F., Somot S., Alias A., Dubois C., Lebeaupin-Brossier C., Nabat P., Adloff F., Déqué M. and Decharme B. (2014) A fully coupled Mediterranean regional climate system model: design and evaluation of the ocean component for the 1980-2012 period. Tellus A, 66, 23967, http://dx.doi.org/10.3402/tellusa.v66.23967 [Samuel Somot, France]	rejected – due to space constraints we do not discuss coupled RCMs here.
54936	60	50			For trends in ocean deep water characteristics with respect to long-term observations at 2300m (Mediterranean Sea), see Somot et al. 2018 (be carefull, not the one already cited in chap 10) : Somot S., Houpert L., Sevault F., Testor P., Bosse A., Taupier-Letage I., Bouin M.N., Waldman R., Cassou C., Sanchez-Gomez E., Durrieu de Madron X., Adloff F., P. Nabat, Herrmann M. (2018a) Characterizing, modelling and understanding the climate variability of the deep water formation in the North-Western Mediterranean Sea. Climate Dynamics, 51(3), 1179-1210, doi: 10.1007/s00382-016-3295-0 [Samuel Somot, France]	rejected – oceans are not be covered in Chapter 10.
21094	61	20	61	31	Consider merge both paragraphs as both mention forcings needed to be included for correctly simulate trends [Gwenaelle GREMION, Canada]	taken into account.
54938	61	20			This sentence is well illustrated in Nabat et al. 2014 for the aerosols and in Sevault et al. 2014 for the SST (depending if it is a forcing or a coupling, http://dx.doi.org/10.3402/tellusa.v66.23967) [Samuel Somot, France]	taken into account – Aerosols have been included, but not the effect of ocean-atmosphere coupling (due to space limits, note the focus is on forcings).
51054	61	21	61	23	insert "within the RCM domains" after "changed GHG concentrations" [Bart Van den Hurk, Netherlands]	accepted
31378	61	23	61	23	per century: which century? 20th? 21st? Not the same trend [Gerhard Krinner, France]	noted – the paper is on both historical and future trends, expressed as trends per century.
6331	61	40	62	35	Mechanism used in determining adequacy of climate models and making regional projections ain't clear to the layman [Isaac Sarfo, Ghana]	rejected – this is why these methods are discussed here. Part of the text has been moved to Chapter 1 anyway.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54942	62	2	64	3	Concerning this topic, very recent or even not-yet published papers may bring important and very relevant results concerning the missmatch between GCM and RCM climate change signal over Europe and the key role of the aerosol forcing in it. Bartok et al. 2017 (already cited) and Soerland et al. 2019 illustrate the missmatch well for shortwave and temperature. Two recently submitted papers (Gutierrez et al. and Boé et al.) will (I hope) bring part of the explanation of this detected missmatch. Hope you will find a place for those studies in the report. Sørland, S. L., Schär, C., Lüthi, D., & Kjellström, E. (2018). Bias patterns and climate change signals in GCM-RCM model chains. Environmental Research Letters, 13(7), 074017. [Samuel Somot, France]	taken into account – has been added.
50402	62	23	62	30	First: The whole paragraph should be re-written, due to complicated and long sentences. Second: it can be added to the paragraph that by using an extended version of the PGW approach, the different causes can be disentangled, which can reduce the uncertainty for some areas and seasons. see Brogli et al. 2019: https://doi.org/10.1175/JCLI-D-18-0431.1 [Silje Soerland, Switzerland]	taken into account –whole subsection has been rewritten. But suggested paper is not relevant as the point is on adequacy-for-purpose, not uncertainty and their separation.
49246	62	25	62	25	Collins et al. (2018) reviews the current state of atmospheric dynamics understanding for regional climate. Collins M, Minobe S, Barreiro M, Bordoni S, Kaspi Y, Kuwano-Yoshida A, Keenlyside N, Manzini E, O'Reilly CH, Sutton R. (2018) Challenges and opportunities for improved understanding of regional climate dynamics, Nature Climate Change, volume 8, no. 2, pages 101-108, DOI:10.1038/s41558-017-0059-8. [Malcolm Roberts, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – has been added
51056	62	30	62	30	What do you mean by "SST climate change signal"? The SST change in response to climate change? [Bart Van den Hurk, Netherlands]	taken into account – text modified
21096	62	37	62	37	Maybe an assessment could be included on the high confidence about the need of better understanding how climate variability operates regionally, widen the knowledge on their forcings, and improving parametrisation of unresolved processes to increase the adequancy-for-purpose of regional projections [Gwenaelle GREMION, Canada]	noted. The text has been rewritten substantially and shortened, links to relevant previous sections have been included. We are happy to discuss further adjustments after the SOD.
36650	62	54	62	54	Citation of Gula and Peltier should not include Peltier's first name. [Seth McGinnis, United States of America]	accepted
54940	63	3			not « stronger » but « reversed ». The sign of the change is opposite in most of the GCM-RCM pairs [Samuel Somot, France]	accepted – text rephrased.
56068	63	4	63	6	Palazzi et al. (2019) used several realisations of one GCM run at different horizontal resolutions (from ~16 km to ~ 125 km) to study of EDW in three mountain areas of the globe, the Colorado Rocky mountains, the Greater Alpine Region and the Tibetan Plateau. They found that the model shows no clear resolution dependence in its ability to detect EDW in the different regions, but the EDW intensity and the relative role of its different drivers (changes in albedo, in downward thermal radiation and in specific humidity) may be dependent on the model resolution. The role of internal climate variability (sampled by the spread of the multi-member ensemble) can be significant in modulating the EDW signal. [Corti Susanna, Italy]	noted – note that the section is not on elevation dependent warming, but on increasing fitness-for-purpose. The cited study is one example. The mentioned paper does not add to this discussion.
56070	63	4	63	6	Palazzi, E., Mortarini, L., Terzago, S. et al. Clim Dyn (2019) 52: 2685. https://doi.org/10.1007/s00382-018-4287-z [Corti Susanna, Italy]	noted – note that the section is not on elevation dependent warming, but on increasing fitness-for-purpose. The cited study is one example. The mentioned paper does not add to this discussion.
31380	63	51	63	51	… and adding RELEVANT model components CAN increase the adequacy… [Gerhard Krinner, France]	accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54560	63	54	63	54	And why is this? The lack of this fit for purpose research for stat downscaling seems odd. It would be good to at some point include a recommendation to do this, or explain why it hasn't been done. This is really important since stat downscaling is used alot for imapcts oriented work. [Linda Mearns, United States of America]	taken into account – we agree that this is important. It now features in the knowledge gaps.
43274	63	54	63	55	(Section 10.3.2.7) seems to be a mistype for (Section 10.3.2.5) [Motoki Nishimori, Japan]	accepted
36646	63	55	63	55	Refers to Section 10.3.2.7 for a discussion of perfect model experiments. No such section exists. I think this should be Section 10.3.2.5 instead. [Seth McGinnis, United States of America]	accepted
54612	64	1	64	1	Dixon et al. 2016 should be cited here regarding perfect model application. [Linda Mearns, United States of America]	accepted
49240	64	17	64	17	Vanniere et al. (2018) would be an example of doing this for global GCMs. Vanniere, B., P. L. Vidale, M.-E. Demory, R. Schiemann, M. J. Roberts, C. D. Roberts, M. Matsueda, L. Terray, T. Koenigk, R. Senan, 2018: Multi-model evaluation of the sensitivity of the global energy budget and hydrological cycle to resolution. Climate Dynamics, doi: https://doi.org/10.1007/s00382-018-4547-y. [Malcolm Roberts, United Kingdom (of Great Britain and Northern Ireland)]	rejected– a PRIMAVERA paper might be added, together with the Haarsma et al. Paper this should actually be enough as an example to make the point. Note also that the paragraph has been removed, but appears in modified form in Section 10.5.4.
32516	64	37	64	37	Suggest “greenhouse gas emissions” → “external forcings” since there are other things that could be important e.g., aerosols. [Isla Simpson, United States of America]	accepted
21098	64	37	64	38	Consider changing “imperfect knowledge and implementation of the response of the climate system to external forcings” with “imperfect knowledge and implementation of climate sensitivity” [Gwenaelle GREMION, Canada]	rejected – climate sensitivity would suggest that global responses are important only.
51058	64	42	64	42	It is not only about avoiding overconfident statements, also avoiding underconfident statements is desirable. I would suggest: to avoid biased confidence statements [Bart Van den Hurk, Netherlands]	accepted
50404	64	52	65	25	The use of cascade of uncertainty could be introduced earlier in the chapter, see comment 1. Moreover, first shown in Kerkhoff et al. (2015) (https://doi.org/10.1175/JCLI-D-14-00606.1), and later in Sørland et al. (2018), the error from GCMs and RCMs are not neccesarily additative, as assumed in the cascade of uncertainty. [Silje Soerland, Switzerland]	Taken into account. The cascade of uncertainty concept is referred to also in section 10.1 to better link this sub-section. The Kerkhoff paper https://journals.ametsoc.org/doi/10.1175/JCLI-D-14-00606.1 looks at the optimal ways to combine GCMs and RCMs to adequately represent the observed uncertainties, taking into account the impact of the bias propagation from the GCM to the RCM, while the Soerland paper https://iopscience.iop.org/article/10.1088/1748-9326/aacc77. Both are included in the SOD text.
51060	65	6	65	14	This listing and subsequent text can be deleted [Bart Van den Hurk, Netherlands]	taken into account – text has been shortened
54944	65	32			Another way of reducing uncertainty is to select GCMs for a given region depending on their present-climate characteristics as done in McSweeney et al. 2015 (already cited). This is an example of how to use the end of the model democracy to reduce uncertainty. Even if CORDEX did not use such a study to plan the simulation ensemble, at the end, it appears that at least Euro-CORDEX and Med-CORDEX modelling groups havelargely favoured the GCMs selected by McSweeney et al. for driving the RCMs. [Samuel Somot, France]	taken into account – this point is mentioned below under ensemble construction. The reference has been added there.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39022	65	34	65	44	This paragraph discusses the limit of conventional approach and need for new, storyline-type of approach. This sort of discussion had better appear earlier, eg, in Chapter 1? [Masahide Kimoto, Japan]	taken into account – it is discussed in Chapter 1 but repeated here to be self-consistent
54972	65	34	65	44	section in chapter 1 where this is presented is 1.5.4. IN this parragraph you should also refer to chapter 4 that assess low-probability -high -impact storylines (4.8). [Rojas Maisa, Chile]	rejected – Chapter 1 gives a very general introduction. Here the issue is discussed from a regional perspective.
14556	65	34	65	45	Another study that would be worthwhile to refer to is that of Madsen et al. (2017; doi:10.1002/2017GL075627). They have discussed limits in the physical plausibility of multimodel regional climate projections. [Stefan Fronzek, Finland]	accepted –reference has been added.
41382	65	38			Is this referring to the fact that confidence intervals exclude the tails of probability distributions? This is a very important consideration. A 95% confidence level still leaves the very real possibility of more extreme conditions, which have a 1:20 chance of occurring, i.e. statistically, one year in 20 will be outside the 'highly probable' range. That is not a negligible chance. A statement on how this could be handled would be useful. Should probability statements include a statement on the full range of model results? Or at least 99% and 99.5% values? page 114 ln 49ff recommends this. Perhaps a brief comment with cross-reference? [Debra Roberts, South Africa]	noted – but this is exactly what the paragraph below is about.
51062	65	39	65	42	I don't understand the logic to have this comment on circulation uncertainty here. There are many other uncertainties at the regional scale that cannot be assessed with a "pseudo-probabilistic" approach [Bart Van den Hurk, Netherlands]	taken into account – has been adjusted
30024	65	49	66	27	The rationale for storyline approaches to regional climate change information is made more generally in Shepherd (2019 PRSA doi: 10.1098/rspa.2019.0013). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	taken into account – the broader rationale is discussed in Section 10.5
51064	65	49	66	27	This section has some connection with text in Atlas.6.1.3; a cross-reference would be good [Bart Van den Hurk, Netherlands]	accepted
32518	66	29	64	46	A potentially relevant reference for this paragraph is Hall et al 2019, Nat. Clim. Change, doi:10.1038/s41558-019-0436-6 [Isla Simpson, United States of America]	accepted
55028	66	30	66	30	General comment. I think it is more useful to give the section in a chapter where some content can be found, rather than just the chapter, hopefully a consistent referencing could be agreed upon. Emergent constraint an be found in 1.4.5.2 [Rojas Maisa, Chile]	taken into account – will be considered in FGD once structure is settled.
51066	66	42	66	44	Not a very clear phrase, about ordinary or total LSq [Bart Van den Hurk, Netherlands]	not applicable, text has been deleted
48066	67	3	67	3	Too many adjectives accompanying the term ?evidence? (some of them are redundant or not very precise): robust, medium, strong, limited, growing, low, emerging, little, adequate, no robust, insufficient, weak, no contradictory, clear. [WGI TSU, France]	Accepted: the text has been revised by replacing evidence with confidence
48416	67	5	67	7	large ensemble simulation explained in Chapter 1 could be referenced here as well [Rondrotiana Barimalala, South Africa]	Accepted: the text has been revised and reference has been added for the SOD
41384	67	26			Another way that ToE can be misleading is that it can be misinterpreted as something other than a statistical phenomenon, by policy makers. For instance, the ToE of atmospheric CO2 is a couple of years, because there is so little internal variability, while the ToE of rainfall changes may be many decades. This does not mean that atmospheric CO2 is a more urgent issue for adaptation, quite the contrary. Please could you add some text to this effect. [Debra Roberts, South Africa]	Noted: no specific text change, no reference suggested and the comment does not separate between forcings and response (we are not discussing here ToE of CO2 …)
32520	67	36	67	36	I'm confused about Figure 10.13. Surely this quantity will depend on where you are averaging in longitude. Is this an average over all possible longitudinal averages of that scale? [Isla Simpson, United States of America]	not applicable – figure has been replaced

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30018	68	5	68	6	Lack of statistical significance (or of detectability) absolutely does not mean unimportant! The implication of the wording here is that the changes may be detectable when aggregated, but even when not aggregated, the statement remains true. In talks I often show Figure 13 of Deser et al. (2012 Clim.Dyn. doi:10.1007/s00382-010-0977-x), which shows a factor of two change in the risk of high or low precipitation even though the change would be undetectable in a single realization. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the text has been slightly revised. Not clear though what the reviewer exactly means with the Deser et al. plot as we are here looking at a large ensemble, not just one simulation.
13096	68	7	68	7	Comparison of the attribution results between different sets of climate models should be added here to show the impact of the improved Signal-to-Noise Ratio due to the improved simulation of natural internal variability. Specific text will be added after '...a better SNR and better detectability of trends.': [Zhou et al., (2018) revealed a reduced attribution uncertainty to anthropogenic forcing for the 2016 extreme rainfall event over Central China using the HadGEM3-A-based system, because of a better SNR induced by better performance in the modeling of large-scale internal variability through adopting the observed sea ice and sea surface temperature than the CMIP5 models.] Reference: Zhou, C., and Wang, K., and Qi, D., (2018). Attribution of the July 2016 extreme precipitation event over China's Wuhan. Bull. Am. Meteorol. Soc., 99, 107-112. doi: 10.1175/BAMS-D-17-0090.2. [Zhou Chunlüe, United States of America]	Rejected: this is not within the scope of the chapter, it should fit in chapter 11.
54946	68	18			Another way to solve the issue of the sparse GCM-RCM-scen matrices is to full-filled the matrices using statistical methods that we could call «RCM statistical emulators ». This has been tried at least in Déqué et al. 2012 (see section 4 of the article for the methods). The paper is already cited. [Samuel Somot, France]	Accepted. Cited as a statistical method that can help fill a matrix with estimated outcomes of missing combinations.
54948	68	18			by the way, their is a confusion between Déqué et al. 2012, 2012a and 2012b. Same paper I would say ? [Samuel Somot, France]	Noted. The paper appears more than once in the FOD reference list, which the copy-editing should fix.
14438	68	33	68	40	The number of papers for Multi-GCM Multi-RCM experiments are limited, and Inatsu et al. (2015) would be one of good example. Inatsu, M., T. Sato, T. Yamada, R. Kuno, S. Sugimoto, M. A. Farukh, Y. N. Pokhrel, and S. Kure (2015): Multi-GCM by Multi-RAM experiments for dynamical downscaling on summertime climate change in Hokkaido. Atmos. Sci. Let., doi: 10.1002/asl2.557. [Shiori Sugimoto, Japan]	Accepted. Cited as another example of using a small set of GCMs and RCMs in a matrix.
30130	68	50			This approach was followed by Heinrich et al. (2014) who tried to fill in missing combinations in the GCM-RCM matrix from the ENSEMBLES project and analysed the representativeness of subsamples. Heinrich, G., Gobiet, A., and Mendlik, T. (2014). Extended regional climate model projections for Europe until the mid-twentyfirst century: combining ENSEMBLES and CMIP3. Climate Dynamics, 42(1–2), 521–535. doi:10.1007/s00382-013-1840-7 [Heimo Truhetz, Austria]	Accepted. Cited more appropriately in previous paragraph
48304	69	18	69	19	This is an incorrect characterisation of the approach in this paper which involves model rejection (where models are clearly implausible for important drivers of regional climate) coupled with selecting from the remaining members based on projection spread (of relevant variables). [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Paper now cited as one guided by the principle of discarding GCMs that unrealistically represent targeted processes.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
54562	69	28	69	30	this statement doesn't make any sense. If you remove poor performing models, then it may very well be that you sensibly change the range of projections, and thus affect the range of uncertainties. [Linda Mearns, United States of America]	Accepted - reworded. But note that if poorly performing models are included, then they are giving a false sense of the range of uncertainty.
30832	69	35	72	37	not clear what is supposed to be the message and content of this box as it is not well organized [Annalisa Cherchi, Italy]	taken into account – the rationale has been rewritten. The structure of the box, however, has been kept – the first parts are in a stringent order, the order of the last parts is rather arbitrary.
36648	70	16	70	16	Refers to Section 10.3.2.7 for a discussion of perfect model experiments. No such section exists. I think this should be Section 10.3.2.5 instead. [Seth McGinnis, United States of America]	accepted
32522	70	33	70	33	Should this be “Finally, other authors”. That changes the meaning a bit. The current statement makes it sound like these authors have finally come up with the definitive answer whereas my suggested change makes it sound like this is just the final statement in this discussion. I’m not sure exactly which is meant. [Isla Simpson, United States of America]	taken into account – the word finally has been deleted
36652	70	33	70	33	Reference to Section 10.3.1.3 should be to Section 10.3.1.4.2 [Seth McGinnis, United States of America]	accepted
48846	71	7	71	7	In Box 10.2 : A more recent paper by Hernández-Diaz et al. (2019) illustrates this approach. CITED PAPER: Hernández-Díaz, L., Nikiéma, O., Laprise, R., Winger, K., and Dandoy, S. (2019) Effect of empirical correction of sea-surface temperatures on the CRCM5-simulated climate and projected climate change over North America. Clim. Dyn., 53, 453-476. [https://link.springer.com/content/pdf/10.1007%2Fs00382-018-4596-2.pdf] [Patrick Grenier, Canada]	taken into account – has been added.
48848	72	22	72	24	In Box 10.2. In the presence of internal variability (substantial or not), there exists a cross-validation approach that does compare the validation data with an ensemble of climate scenarios as a whole instead of just with an individual scenario (Gennaretti et al. 2015). This approach consists in seeking as many independent cases as possible (different locations, different validation periods), and to construct the verification rank histogram for the observations within the ensemble of scenarios with which they are expected to be statistically indistinguishable. A flat histogram suggests a successful bias adjustment method, even in presence of strong internal variabilty (which is of course nonsynchronized among the individual climate scenarios and the observations). CITED PAPER : Gennaretti, F., Grenier, P., and Sangelantoni, L. (2015) Toward daily climate scenarios for Canadian Arctic coastal zones with more realistic temperature-precipitation interdependence. J. Geophys. Res., 120(23), 11862-11877. [https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015JD023890] [Patrick Grenier, Canada]	taken into account. The paper turned out to include only insufficient or convoluted explanations of the cross validation approach. It has therefore been decided not to include it.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48844	72	31	72	37	In Box 10.2. These recommendations are welcome, but maybe not down-to-earth enough. It is true that an understanding of the physical processes behind biases is important, but in the daily work of climate services centers, this is rarely an issue, especially when simulations from tens of different models are adjusted for a same project, because each model has biases for different reasons and it is practically imposible to track bias sources and inform the end user about all this. However, more practical recommandations for climate services centers exist, including the avoidance of direct inter-variable physical inconsistency at a given timestep, for example cases where daily tasmin may exceed its corresponding tasmax value. The recommandation is then to adjust biases in tasmax and in the diurnal temperature range (DTR) and next to deduce tasmin (Thrasher et al. 2012). Another example concerns relative and specific humidity, linked to temperature and pressure by a set of equations. In such case, keeping physical consistency implies that one variable has to be considered as dependant and deduced after the other (independant) variables have been adjusted, and it is recommended to directly post-process relative humidity rather than specific humidity (Grenier, 2018). CITED PAPER: Thrasher, B., Maurer, E. P., McKellar, C., and Duffy, P. B. (2012). Technical Note: Bias correcting climate model simulated daily temperature extremes with quantile mapping. Hydrology and Earth System Sciences, 16(9), 3309–3314. http://doi.org/10.5194/hess-16-3309-2012. [https://www.hydrol-earth-syst-sci.net/16/3309/2012/] CITED PAPER: Grenier, P. (2018). Two types of physical inconsistency to avoid with univariate quantile mapping: a case study over North America concerning relative humidity and its parent variables. Journal of Applied Meteorology and Climatology. 57, 347–364. http://doi.org/https://doi.org/10.1175/JAMC-D-17-0177.1. [https://journals.ametsoc.org/doi/full/10.1175/JAMC-D-17-0177.1] [Patrick Grenier, Canada]	rejected. These recommendations are of practical use for providing « industrial » climate projections. But this is not the purpose of this box. One could of course add a short paragraph pointing towards these issues, but the box is already far too long, such that we decided not to consider these issues.
51070	72	32	72	32	"such dissimilarities": which? [Bart Van den Hurk, Netherlands]	taken into account. It seems the sentence this statement refers to has been deleted. The sentence has been adjusted accordingly.
48306	72	42	72	42	Suggest considering condensing this whole section to describes principles with 1-2 examples with the rest of the material (much of which includes useful, if rather lengthy, findings) moving to the Atlas (suitably shortened). [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: after discussion at LAM3, it has been decided that chapter 10 keeps the attribution part and the projection part for each example will be merged in the Atlas if deemed appropriate
48418	72	42			For a nice flow of the text, it would be nice to have a consistent structure for each case study in ths section. As it is now, each case study has diferent style , some start with a description of the general climate in the area, the others start directly on the past changes (e.g. 10.4.2.2.1 vs 10.4.2.2.3). [Rondrotiana Barimalala, South Africa]	Accepted: the text has been revised for the SOD in order to have a more consistent structure for all the examples
48078	72	48	72	48	The list of selected case studies presented (10.4.1) roughly follows the order of the regional chapters of the WGII report. There is a need to make sure that results shown in Chapter 10 and WGII are consistent. [WGI TSU, France]	Noted: cross-working regional group between WG1 and WG2 have been set up to check consistency
32524	72	50	72	52	A large amount of climate variability arises just from internal atmospheric variability i.e., weather noise. Suggest making this clear. [Isla Simpson, United States of America]	Accepted: the SOD text has been revised to acknowledge this point
30834	72	50	72	52	actually there is also more than these 3 modes. These lines could be removed [Annalisa Cherchi, Italy]	Rejected: these modes are mentioned here as an illustration with no pretention to be exhaustive

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
29616	72	52	72	52	PDV is mentioned several times, but the term is never introduced [Rodrigo Manzanas, Spain]	Taken into account: the acronym has been introduced once (in section 1) for the whole chapter in the SOD.
48070	72	52	72	52	PDV is mentioned several times, but the term is never introduced. [WGI TSU, France]	Taken into account: for the SOD, the acronym has been introduced once for the whole chapter (in section 1) in the SOD.
39644	72	55	73	7	This definition seems to be essentially the same one than that included in SR1.5 glossary for "Climate Change". The report should have a single definition of "Climate Change" consistent across chapters and with the other reports. Check that consistency [Carolina Vera, Argentina]	Taken into account: the text has been revised to make sure that it is fully consistent with the SR1.5 glossary
46972	73	1	73	7	10.4.1 Is this wise or simply consistent withe IPCC mandate? [Laura Gallardo, Chile]	Noted. Yes, this is fully consistent with the SR1.5 glossary (no text revision).
30836	73	5	73	7	meaning not clear, I suggest to rewrite [Annalisa Cherchi, Italy]	Rejected: the text does follow the SR1.5 glossary.
41386	73	12			Yes, this is important. Statistical significance is not useful in things with severe or deadly consequences. [Debra Roberts, South Africa]	Noted: we agree with the reviewer
30838	73	20	73	21	and where this complete assessment is supposed to be find? [Annalisa Cherchi, Italy]	taken into account: the text has been revised to indicate that regional projections can be found in the atlas chapter
30840	73	26	73	42	how and why these specific cases are identified?Figure contain 8 case not 10 as indicated on line 10 above [Annalisa Cherchi, Italy]	Taken into account : the Cities and Mountains have been put in two separate boxes, in addition to the 8 regional illustrative examples.
51072	73	38	73	39	What defines the area of interest for attribution? Why is the area for the NE Asia temperature case study so short? [Bart Van den Hurk, Netherlands]	Taken into account: the text has been revised to include the rationale of the area choice. We have assumed that the second part of the comment is about the duration and not the area as written. This period is that of the hiatus. It is meant to illustrate that decadal regional changes with large amplitude can be due to internal variability.
48308	73	47	72	47	I have some more specific comments on elements of this section but overall I am not convinced about using "Attributing" as much of the material presented is not consistent with the framing/definitions in the relevant Ch 1 box. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: the framing in the detection and attribution chapter 1 box does include a broader perspective for attribution, including the fact that detection is not always needed to perform attribution and that all drivers, including internal variability ones, need to be considered at regional scales.
53820	73	47	92	14	section 10.4.2 contains material (GHG and aerosol RF etc) that needs coordination with ch7 and ch4. [Jan Fuglestvedt, Norway]	Taken into account: consistency has been checked for the SOD
44550	73	47			Very interesting section! Aerosol influence is mentioned in several places. It would be good to link this to process based discussions in Chapter 6, and maybe exchange some references as the discussions currently seem to cover two quite separate bodies of work. [Bjorn Samset, Norway]	Taken into account: consistency and complementarity with other chapters have been checked for the SOD
30020	73	50	73	56	This more general definition of attribution is also important for the connection to WGII, since WGII does not require the preliminary detection step. This point is made explicitly within a storyline context by Shepherd (2019 PRSA doi: 10.1098/rspa.2019.0013). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the reference has been added for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48310	73	51	73	52	The correct reference here (should you keep this text following my comment on 73/47) should be the Ch 1 box on attribution. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the reference to the chapter 1 box on D&A has been added for the SOD
41388	73	54			AMV? PDV? [Debra Roberts, South Africa]	Taken into account: the two acronyms have been introduced once (in section 1) for the whole chapter in the SOD.
48312	73	57	73	57	Should you keep this text following my comment on 73/47 it should be made consistent with the Ch 1 box on attribution [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted
21100	73				Figure 10.15: Does SAT in the timeseries plots represent annual mean temperature? [Gwenaelle GREMION, Canada]	Accepted: the legend has been completed with the SAT definition
21102	73				Figure 10.15: In the precipitation time series, green and ochre represent positive and negative precipitation anomalies respectively. However, There are thin ochre (green) lines at the edges of green (ochre) bars.The PR time series plots need to be redrawn to remove these thin lines. Figure caption should also explain that red (blue) means positive (negative) SAT anomalies and green (ochre) means positive (negative) PR anomalies. [Gwenaelle GREMION, Canada]	Accepted: the figure has been corrected to remove the thin lines
51074	74	2	74	4	Very good to expand the attribution in Ch 3 to the regional scale [Bart Van den Hurk, Netherlands]	Noted
30842	74	13	74	13	why here? These subsection 10.4.2.1 should be part of sec 10.1 [Annalisa Cherchi, Italy]	Rejected: Section 1 is the introductory and framing section for the whole chapter. It does not cover the specific tools and methodological aspects relevant for constructing regional messages. These are dealt with in subsequent sections.
48314	74	15	74	18	Why is there no mention here of the more standard methods of attribution of comparing simulations with and without relevant drivers with each other and observed changes or events. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the text has been revised for the SOD and a new paragraph assessing studies based on standard detection and attribution methods has been added.
44024	74	15	74	18	Suggested text to add: "A third method in+I75 use for regional detection and attribution is the univariate (gridpoint based) detection and attribution (UDA) method." [Thomas Knutson, United States of America]	Taken into account: the text has been revised for the SOD and relevant references have been added
30022	74	28	74	29	I don't understand how the influence of remote drivers can be detected this way, since that influence will surely be mediated through teleconnections in the atmospheric circulation, which are removed in this methodology. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Noted: dynamical adjustment based on constructed analogues has an additional "ensemble" step that allows to determine the influence of atmospheric circulation given mean (climatological) surface conditions. The residual then includes possible changes due to abnormal ocean or land conditions mediated by atmospheric circulation and the purely thermodynamical contribution (see Deser et al. 2016 for details).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32526	74	29	74	30	I think another, perhaps even more key assumption of these methods is that the external forcing or ocean and land drivers do not act through changes in the circulation. I think this should probably be mentioned. [Isla Simpson, United States of America]	Noted: Actually, it is not really an assumption of the method; what the method simply does is just to include these contributions into the residual. Additional analyses need to be done to assess a possible forced circulation change.
30026	74	29	74	30	This sounds more like a definition of the residual than an assumption of the method. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the text has been revised for the SOD to specify that linearity between temperature and sea level pressure is assumed in the constructed analogue method.
32528	74	32	74	42	Perhaps another relevant reference here is Guo et al (2019), GRL, 46, doi:10.1029/2018GL081316. [Isla Simpson, United States of America]	Accepted: the reference has been added for the SOD
30028	74	32	74	42	You need to state clearly that dynamical adjustment, by construction, cannot account for the component of the forced response associated with circulation changes that project onto internal variability. Thus it only represents part of the regional climate change problem. Zappa et al. (2015 ERL doi: 10.1088/1748-9326/10/10/104012) show that in the CMIP5 models, nearly all of the projected wintertime precipitation decline across the Mediterranean region is mediated by atmospheric circulation and congruent with internal variability (yet well outside sampling uncertainty), so this can potentially be a very large part of the forced response. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Noted: thanks for the comment. We note that the Zappa et al. study is about future projections and not attribution of past changes. The use of dynamical adjustment and a large ensemble can lead to a complete decomposition (forced, internal, dynamic, thermodynamic) for observations and a single ensemble member (see Figure 9 and related text in Deser et al. 2016).
21104	74	32	74	42	This paragraph is somewhat redundant. This paragraph can be integrated into the previous paragraph from line 20 to 30. [Gwenaelle GREMION, Canada]	Rejected: the paragraph gives specific application examples while the previous one gives details about the methods
32530	74	40	74	42	I'm not sure whether this statement is only referring to summer. But the study of Yamamoto and Palter 2016, Nature Communications, doi: 10.1038/ncomms10930 argues the opposite of this for winter, I think. [Isla Simpson, United States of America]	Accepted: the text has been revised to include the seasonal aspects and new references (such as Yamamoto and Palter and others)
30030	74	44	74	54	Perhaps I misunderstand, but it sounds like EEMD just assumes that anything with a sinusoidal time dependence is variability, and the residual linear trend is forced. That is so incredibly naïve that I am surprised you can even call this a method. Clearly this is some kind of assumption, and needs to be stated as such. But we do know that (i) the forced change will not be a linear function of time, if the forcing is not a linear function of time, and (ii) climate variability has power on all timescales. Therefore the method seems intrinsically flawed. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Noted: this is a misunderstanding of the EEMD method. EEMD is a well known non-parametric decomposition method among many others such as Fourier spectrum-based filtering and wavelet decomposition.It turns out that EEMD has some nice properties that other decomposition methods do not possess (see Ji et al. 2014 doi:10.1038/NCLIMATE2223 and references therein). Note that EEMD does not tell you what is forced or internal. The EEMD user can decide whether or not to include low-frequency intrinsic mode functions in the forced response (thus performing sensitivity analysis) in addition to the nonlinear monotonic residual (the residual has no reason to be linear). Indeed, EEMD is usually used in complement to other more physically-based approaches.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51076	74	47	74	47	Difficult to imagene a time series without further oscillations (around zero) [Bart Van den Hurk, Netherlands]	Noted: the text has been changed to "leaves behind a monotonic residual time series". See Ji et al. 2014 Supp. Material doi:10.1038/NCLIMATE2223 for a simple illustration.
51078	74	49	74	49	what is the preceding IMF? [Bart Van den Hurk, Netherlands]	Taken into account: the text has been revised for the SOD to better describe the EEMD decomposition method
32532	75	1	75	7	Is a perturbed physics ensemble really necessary for this? Couldn't this also be achieved with an initial condition ensemble? If so, suggest a statement to that effect. If not, suggest clarrifying why the perturbed physics aspect was necessary. [Isla Simpson, United States of America]	Accepted: yes, this has been acknowledged in the SOD text.
30032	75	1	75	13	This method seems highly prone to errors due to sampling variability. How can you be sure that the linkages found across the different ensemble members are causal and not simply due to unrelated aspects of internal variability? [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: this has been acknowledged in the SOD text.
44026	75	14	75	14	Suggested text to add: "A further method in use for regional detection and attribution is the univariate (gridpoint based) detection and attribution (UDA) method (e.g., Knutson et al., 2013; Knutson and Ploshay 2016; Knutson and Zeng 2018). WIth this method, one does not use pattern information, but compares observed trends in gridpoint datasets with distributions of trends from ensembles of historical runs (natural forcing only versus all forcings) combined with distributions of internal variability trends from long control runs. Consistency between observed and historical simulation trends is also assessed. The tests can be applied independently over large numbers of gridpoints (e.g., globally where sufficent data exist) and the fraction of area classified as detectable, attributable, or consistent/inconsistent is assessed. This method is useful for an initial assessment of detection/attribution and consistency for a region, and has been used to infer detectable increases in surface temperatures (Knutson et al. 2013) and summertime mean heat stress via wet bulb globe temperatures (Knutson and Ploshay 2016), as well as in precipitation (wetting and drying) trends (Knutson and Zeng 2018)." References: Knutson, T.F. , Zeng, and A. Wittenberg (2013), Multimodel Assessment of Regional Surface Temperature Trends: CMIP3 and CMIP5 Twentieth-Century Simulations. J. Climate, v. 26, pp. 8709-8743 (see Fig. 10). Knutson, T.R. & Ploshay, J.J. (2016) Detection of anthropogenic influence on a summertime heat stress index. Climatic Change 138: 25 (See Fig. 5). Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c). [Thomas Knutson, United States of America]	Accepted: this method has been added in the SOD text with the appropriate references

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30844	75	16	75	16	sect 10.4.2.2 should be shortened. How the factors responsible for recovery win over those responsible for drying as they are active in both periods? [Annalisa Cherchi, Italy]	Accepted: In the SOD we have taken care to clearly describe the relevant factors responsible for drying and recovery and how they interact to produce the change in both periods. The section has been made more concise by avoiding repetition. (Note that overall: Section 10.4 is much shorter, since the case-by-case subsections on regional future projections have been removed.)
47456	75	16	82	43	Subsection 10.3.2.2 on regional climate change attribution case studies needs coordination with Chapter 8 (8.3.2.4 on monsoons). Some overlaps between chapters are inevitable but there are considerable overlaps between 8.3.2.4 and 10.4.2.2. Consistency check and cross-referencing seem necessary. Checking points: 8.3.2.4.4 (West African monsoon) and 10.4.2.2.1 (The Sahel and the West African monsoon drought and recovery), 8.3.2.4.3 (East Asian summer monsoon) and 10.4.2.2.2 (East Asian summer monsoon weakening), 8.3.2.4.7 (Australian and Maritie Continent monsoon) and 10.4.2.2.3 (Southern Australian rainfall decline). [June-Yi Lee, Republic of Korea]	Taken into account: the text on the Sahel has been updated to cross-reference Section 8.3.2.4
32534	75	16	91	11	I realize that the figures for many of these case studies are placeholders. But I think more could be done than simply providing a schematic as is done for some of them. I suggest presenting them in a uniform way and presenting the observed trend in relation to the CMIP6 trend and, where possible the trends in large ensembles. I think the role of internal variability in these things hasn't adequately been addressed and a figure that shows the externally forced trend from models and the ensemble spread that gives us an idea of the variations in that trend that could arise from internal variability and placing the observed trend within the context of these distributions would be beneficial and would help to frame the discussion.. [Isla Simpson, United States of America]	Accepted: thanks for your comment. The section 4 figures have all been redrawn along these ideas for the SOD
57848	75	16			It can be added the relationship between climate and the spatial distribution of organic carbon contents in volcanic soils (cos) of the Teziutlán region, in the state of Puebla, Mexico. The obtained results allow to verify the strong relation of the climatic variables with the carbon dynamics in the soil and to establish that the cos occurs in areas with approximate temperatures of 15.5 to 16 ° C and with approximate rainfall of 120 to 280 mm per year. Science on the border: science and technology magazine of the UACJ. Volume xii, pp. 55-63, 2014 / Printed in Mexico ISSN 2007-042X Copyright © 2014 UACJ. [Gladys Linares-Fleites, Mexico]	Rejected: This comment is not relevant to the specific regional illustrative examples listed in Section 10.4.
48316	75	18	75	18	This is not an attribution study but an assessment of multiple lines of evidence - so could be a good example of this approach. It is also very long and needs to be much more concise. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: The revised version of Section 10.4.2 for West Africa/Sahel has been made more concise and avoids repetition. In addition, the aspects of future projection have been removed, further shortening this and all examples in Section 10.4.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44548	75	18			Would this study be of relevance here? https://www.nature.com/articles/ncomms11236 [Bjorn Samset, Norway]	Rejected: the remit of the suggested paper is to Southern Africa and therefore cannot be assessed here. We have passed this on to colleagues working on an assessment of the Cape Town drought in Section 10.6. If other literature is found related to biomass burning and changing rainfall over the Sahel and West African monsoon, we will of course assess it for inclusion here.
48420	75	18			An additional reference on the WAM Cook and Vizy, 2019 (https://link.springer.com/article/10.1007/s40641-019-00130-1); [Rondrotiana Barimalala, South Africa]	Taken into account: The suggested paper has been assessed and used to support existing articles in the SOD relating to enhanced warming of the Sahara relative to surrounding regions.
41390	75	36			This is very important with regard to NDVI based studies, which always start in the 1980s (because that is when the satellite was launched), so NDVI baselines are always during the peak of this dry spell. The implications are obvious – e.g. talk of 'greening' of Sahel due to CO2 fertilization versus recovery from an extended drought. A note on this perhaps? – and also on the 'tripling of intense storms since 1982 in satellite observations' mentioned on page 77 line7. [Debra Roberts, South Africa]	Rejected: The references provided in this case study do not provide evidence based on NDVI satellite measures. Instead they provide either direct or modelled assessments of rainfall. In addition, we do not describe greening of the Sahel; likewise CO2 fertilisation is beyond the scope of this section, unless some relevant references can be provided to the contrary.
21108	75	37	75	41	It would be better to provide more detailed information on 'Recently' and 'the current period'. The previous sentece is about the trend until the mid-to-kate 1980s. Are 1990s included in the recent or current periods? [Gwenaelle GREMION, Canada]	Accepted: 'Recently' has been modified to 'mid-1980s'; the current period has the same meaning and has also been revised.
54158	75	45	75	45	After the end of the sentence "increased by 2–6% per decade.", I propose to add: "Bichet and Diedhiou (2018a, b) showed that during the last 30 years (1981-2014), West African Sahel has become wetter, but dry spells are shorter and more frequent and over Guinea Coast, they showed that there are less frequent and more intense rainfall along the coast of the Gulf of Guinea in West and Central Africa." [ARONA DIEDHIOU, Cote d'Ivoire]	Accepted: The two references have been added with note of their CHIRPS data study.
21106	75				Figure 10.16: The resolution of Figure 10.16 is too low. Texts are not clearly legible. [Gwenaelle GREMION, Canada]	Noted: The schematic diagram has been removed from the SOD, although the spirit of this comment is accepted for the purpose of other figures: Legibility of text to be improved in revised version.
21110	76	19	76	20	This paragraph is all about anthropogenic aerosol emissions. It would be better to replace anthropogenic forcings with anthropogenic aerosol emissions. [Gwenaelle GREMION, Canada]	Accepted: This and the following paragraph have been carefully revised and written in a more logical order, avoiding repetition and grouping similar topics together. Anthropogenic aerosol forcing has been clearly labelled as such.
21118	76	19	76	43	These two paragraph should be restructured. Both paragraphs include studies showing aerosol emission impact. [Gwenaelle GREMION, Canada]	Accepted: This and the following paragraph have been carefully revised and written in a more logical order, avoiding repetition and grouping similar topics together. Anthropogenic aerosol forcing has been clearly labelled as such.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21112	76	20	76	20	Don't natural dust aerosols play a more important role than anthropogenic aerosols? [Gwenaelle GREMION, Canada]	Noted, although the purpose of Section 10.4.2 is the attribution of past climate change. Therefore, there must also be some varying driver that is external to the system or anthropogenically forced. Local dust would qualify as a feedback, which, while it may go on to affect the WAM/Sahel, is really a feedback to some forcing from elsewhere.
41392	76	21	76	23	This sentence is not clear. Does Boreal summer Sahel rainfall mean 'far northern' bordering the Sahara? If yes, consider using those words instead. [Debra Roberts, South Africa]	Accepted: "Boreal summer" has simply been replaced by "summertime"; it is obvious from the context that it refers to the northern hemisphere.
21114	76	29	76	29	Please be more specific and differentiate this paragraph from the previous one. Anthropogenic emissions => anthropogenic GHG emissions [Gwenaelle GREMION, Canada]	Accepted: This and the following paragraph have been carefully revised and written in a more logical order, avoiding repetition and grouping similar topics together. Anthropogenic aerosol forcing has been clearly labelled as such.
21116	76	34	76	43	These sentences should be moved to the previous paragraph. [Gwenaelle GREMION, Canada]	Accepted: This and the following paragraph have been carefully revised and written in a more logical order, avoiding repetition and grouping similar topics together. Anthropogenic aerosol forcing has been clearly labelled as such.
21120	77	12	77	12	What is the WAM 'recovery'? Is this same as the Sahel recovery in Line 14? Also does the Sahel recovery mean the rainfall recovery in Sahel? [Gwenaelle GREMION, Canada]	Accepted: An additional sentence has been added to the opening paragraph to draw attention to the ambiguity in terminology.
30846	77	33	77	33	this sahel region is different from that defined before on page 75 line 41 [Annalisa Cherchi, Italy]	Noted: The statement here has been adjusted to clarify meaning; this is the way the Sahel has been defined in this particular study.
49248	77	41	77	41	Vellinga et al. (2016) show that most CMIP5 models also do not capture the magnitude of the Sahel decadal rainfall variability, and that this is associated with many models not being capable of producing heavy rainfall events as part of a teleconnection with the AMO. Vellinga, M., M. Roberts, P. L. Vidale, M. Mizielinski, M.-E. Demory, R. Schiemann, J. Strachan, C. Bain, J. Kettleborough, P. Good, I. Edmond, E. Hibling, 2016: Organised convection as the main carrier of Sahel rainfall variability at multi-annual timescales. GRL, doi:10.1002/2015GL066690. [Malcolm Roberts, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: This caveat has been introduced earlier in the paragraph by citing the suggested Vellinga study, alongside the Giannini and Kaplan reference which linked CMIP5 to external forcing.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44028	77	42	77	42	Suggest to add here: "Knutson and Zeng (2018) found evidence for detectable anthropogenic drying (decreasing precipitation trends) over parts of northern tropical and subtropical Africa for the period 1901-2010. Their results indicated that the observed drying trends over the 110-year period were highly unusual compared to model simulated natural variability, but were consistent, at least in direction, with the decreasing trends simulated in CMIP5 historical runs. In some cases, the observed drying trends were significantly stronger than simulated in the historical runs, even accounting for internal variability contributions, as simulated by the models." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c). [Thomas Knutson, United States of America]	Accepted: This work has now been cited, although we note in response that it is perhaps unwise to compute a linear trend map over such a long period (110-years) when there is strong evidence to suggest that considerable multi-decadal variability (whether forced or not) has taken place over this region.
32536	77	43	77	50	I'm surprised to see there is "high confidence" that external forcings are responsible for the SST variability in the North Atlantic. I think there is still a debate in the literature over the role of external forcings and internal variability in the AMV. Perhaps it depends what region I being referred to, but I think in the sub-polar gyre region of the North Atlantic there are still arguments on either side for it being internal variability or external forcings. Can it really be concluded that there is no role for internal variability in the North Atlantic SSTs? [Isla Simpson, United States of America]	Accepted: We have reduced the level of confidence to medium in the statement relating to the causes of surface temperature change given the possibility that surface temperature change in the North Atlantic may also have been caused by internal variability.
30848	77	43	77	50	how do CMIP6 models reproduce these phenomena? And what is supposed to be expected in the future (projections)? [Annalisa Cherchi, Italy]	Taken into account: If CMIP6 published work is submitted prior to the end-2019 deadline, it will be assessed for the final draft. No comprehensive CMIP6 studies have been found so far, although we have added reference to model performance from the Martin et al. (2017) paper, which examines prototype CMIP6 models. Note that this section is not a comprehensive test of model performance. (The future part of your comment is also outside the remit of Section 4.)
48318	77	53	77	53	Similar to my comment on 75/18 and covered more succinctly in the Atlas so maybe not needed here. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: after discussion at LAM3, it has been decided that chapter 10 keeps the attribution part and the projection part for each example will be merged in the Atlas if deemed appropriate
50108	77	53	78	8	The title should be East-Asian summer monsoon weakening and recovery [Hong-Li Ren, China]	Accepted. Title of subsection has been revised.
41394	77	53			Too many acronyms make this section hard to read. [Debra Roberts, South Africa]	Accepted. We have striven to reduce the number of acronyms for the SOD.
21122	78				Figure 10.17: Again, the resolution of Figure 10.17 is too low. Texts are not clearly legible. [Gwenaelle GREMION, Canada]	Accepted: a new figure is being drawn for the SOD

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45266	79	13	79	13	"Given that the observational studies of precipitation in China is not enough, especiall the emerging literatures regarding the spatial extent where rainfall occurs, the following paragraph can be considered to be added to the end of line 13 on page 10-79: ""Recent observational studies indicate that the summertime local-scale rainfall frequency experienced significant declining trend throughout the whole eastern China in recent decades, which is most likely due to the increases in aerosol burdens (Guo et al., 2017). Days et al. (2018) argued that the SFND pattern is largely dominated by the frontal rainfall rather than nonfrontal rainfall, based on the Frontal Rain Event Detection Algorithm (FREDA) used to partition the rainfall into frontal and nonfrontal components. The above-mentioned observational studies provide new insight into the well-known SFND pattern. Therefore, to better quantify the relative roles of GHGs, anthropogenic aerosols, and natural variability in long-term rainfall change in China, the spatial extent or domain that the rain actually falls merits much attention in the future."" References: Day, J.A., Fung, I., and Liu, W., 2018, Changing character of rainfall in eastern China, 1951–2007, Proceedings of the National Academy of Sciences, 115 (9) 2016-202. doi:10.1073/pnas.1715386115 Guo, J., Su, T., Li, Z., Miao, Y., Li, J., Liu, H., Xu, H., Cribb, M., and Zhai, P., 2017. Declining frequency of summertime local-scale precipitation over eastern China from 1970–2010 and its potential link to aerosols, Geophysical Research Letters, 44, 5700–5708, doi:10.1002/2017GL073533." [Jianping Guo, China]	Accepted. Text has been revised. The first sentence has been added to text. Since we are focusing on the long-term changes and possible drivers of EASM, the first reference (Day et al., 2018) has not been cited.
44030	79	22	79	22	Suggest to add: Knutson and Zeng (2018) found little evidence for a large-scale anthropogenic weakening of the East Asian Monsoon, based on their gridpoint based UDA analysis and comparison of observed precipitation trends over 1901-2010. This further supports the notion that internal variability has dominated over anthopogenic influence in this region, as least in terms of trends over the past century." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c). [Thomas Knutson, United States of America]	Accepted. Text has been revised.
30850	79	26	79	29	and what about in CMIP6? [Annalisa Cherchi, Italy]	Taken into account: If CMIP6 published work becomes available later, we will include the assessments od the model performance for the historical period in this section.
48320	79	31	79	31	Again, not an attribution study and maybe more relevant in the Atlas (in more concise). [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: after discussion at LAM3, it has been decided that chapter 10 keeps the attribution part and the projection part for each example will be merged in the Atlas if deemed appropriate. The definition of attribution in section 4 is covered in the chapter 1 box on detection and attribution
32540	79	33	81	11	I'm surprised that there isn't really a mention of the relative roles of ozone depletion versus other anthropogenic forcings here. Is this not relevant to the discussion? [Isla Simpson, United States of America]	Taken into account: the text has been revised to comment on the possible role of ozone (only briefly as the number of relevant papers is very small)

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30242	79	34	79	34	The Christensen et al 2019 citation does not seem to fit. Probably 2007 is meant. [Ole B. Christensen, Denmark]	Accepted: the reference has been changed for the SOD
30236	79	34			The Christensen et al 2019 citation does not seem to fit. Probably 2007 is meant. [Ole B. Christensen, Denmark]	Accepted: the reference has been changed for the SOD
30852	79	42	79	44	what sections in the map of trend are the regions of interest for this assessment and why? The whole eastern Australia has a negative trend, is the origin different? Alternatively, from the map you can identify 3 regions from west to east with drying, wetting, drying, and this distinction seems more neat than that north/south [Annalisa Cherchi, Italy]	Accepted: the exact definition of the Australian region has been revised for the SOD, it is the southwestern part of Australia
51080	79	42	79	44	The explanation of mechanisms in this Australian example is less clear than the text boxes in the previous illustration figures [Bart Van den Hurk, Netherlands]	Taken into account: this has been defined more precisely in the SOD text based on a refined definition of the region under scrutiny (southwestern Australia)
21124	79				Figure 10.18: Again, the resolution of Figure 10.18 is too low. Texts are not clearly legible. [Gwenaelle GREMION, Canada]	Not Applicable: a new figure has being redrawn for the SOD
44034	80	26	80	30	Suggest to add: "Century scale anthropogenically driven decreases in southwest Australian precipitation have been attributed to ozone depletion and greenhouse gas-induced warming (Delworth and Zeng 201x; see also Knutson and Zeng 2018). " References: Delworth, T. L. and F. Zeng (2014): Regional rainfall decline in Australia attributed to anthropogenic greenhouse gases and ozone levels. Nature Geoscience, volume 7, pages 583–587. Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c; see also their supplemental material for seasonal UDA attribution results if needed). [Thomas Knutson, United States of America]	Taken into account: the reference has been added and discussed in the SOD text
48422	80	32			This section should focs on past changes only, to avoid any confusion, it would be nice to keep the "projection" to be in the next section [Rondrotiana Barimalala, South Africa]	Accepted: the text has been revised for the SOD and now focus only on past changes
32538	80	38	80	38	Again, I think a statement like this needs to be backed up with some quantitative analysis. e.g., what is the CMIP6 ensemble mean trend and how does that compare with obs and what is the uncertainty due to internal variability? Is the observed trend outside of the range of trends that could arise due to internal variability alone? [Isla Simpson, United States of America]	Accepted: a new figure has been drawn to illustrate this specific point for the SOD
21126	80	41	80	42	but -> and. [Gwenaelle GREMION, Canada]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44032	80	51	80	51	Suggest to add here: "Knutson and Zeng's (2018) gridpoint-based UDA analysis of precipitation trends over the period 1951-2010 inferred detectable anthropogenic decreases (drying) over parts of near-coastal southeast Australia and extending south to Tasmania, as well as in extreme southwest Australia. However, trends over part of the region with significant decreasing precipitation in southeast Australia were not attributed to anthropogenic forcing because the ensemble of the CMIP5 historical runs they analyzed showed an increase in precipitation in those regions. " Reference: Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 4c; see their supplemental material for seasonal UDA attribution results if needed). [Thomas Knutson, United States of America]	Taken into account: the reference has been added and discussed for the SOD
32542	81	10	81	11	Again, it seems like this statement needs to be backed up with some quantification on the magnitude of the trends expected from external forcing, relative to those expected from internal variability. Perhaps this is within all the cited references but I don't really see any clear quantification in the text. [Isla Simpson, United States of America]	Accepted: the text has been substantially revised for the SOD and a new figure has been drawn to support the attribution statement
30854	81	10	81	11	and what about in CMIP6? [Annalisa Cherchi, Italy]	Taken into account: a new figure has been drawn for the SOD with available results from CMIP6 models
48322	81	14	81	14	Same as my comment on 79/31, i.e. on 10.4.2.2.3 which also applies to 10.4.2.2.5-8. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted: after discussion at LAM3, chapter 10 keeps the attribution part and the projection for each case study will be merged in the Atlas. The definition of attribution as defined in section 4 is included in the cross-chapter box on detection and attribution.
51082	81	14	81	28	Is Rio de Janeiro part of this SESA region? It experienced a major drought in 2015, and this might deserve a comment [Bart Van den Hurk, Netherlands]	Noted: the SESA domain does not include the region around Rio.
48632	81	14	82	43	The discussion on Regional climate change attribution case studies (Southerastern SA 10.4.2.2.4) is partially overlapping with Atlas South America subsection [Lincoln Alves, Brazil]	Noted: as far as the Atlas text is consistent with the section 10.4.2.2.4 this is not seen as a problem.
42666	81	14			The discussion in this section is based on precipitation. However, the concept of wetting should also consider evapotranspiration and atmospheric demand. In general mean precipitation increases in SESA, but so does mean evapotranspiration (Menéndez et al, 2016). The recent work by Zaninelli et al (2019) explores the net impact on wetting for this region taking into account projected changes in precipitation, evapotranspiration and atmospheric demand. Menéndez et al. 2016: Hydrological cycle, temperature and land surface-atmosphere interaction in La Plata Basin during summer: response to climate change, Climate Research, doi 10.3354/cr01373 Zaninelli et al. 2019: Future hydroclimatological changes in South America based on an ensemble of regional climate models. Climate Dynamics, https://doi.org/10.1007/s00382-018-4225-0 [Claudio Guillermo Menéndez, Argentina]	Rejected: although it is acknowledged that the change in P-ET is an important subject of study, the case studies are examples of attribution of regional changes in climate and must consider variables that has been substantially addressed in the literature, in this case precipitation increase in SESA.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21128	81	15	81	16	There is a good reference for the precipitation trend in SESA: Soares et al. (2017), Can significant trends be detected in surface air temperature and precipitation over South America in recent decades?, https://doi.org/10.1002/joc.4792, International Journal of Climatology. [Gwenaelle GREMION, Canada]	Accepted, reference has been included in page 81, lines 40-45 (observed evidence).
8876	81	15	81	18	South America is a data-scarce region of the world and therefore it is natural to doubt on the robustness of a century-long trend. I think it is worth including this reference at the beginning of the section: Gonzalez, P. L., Goddard, L. and Greene, A. M. (2013), Twentieth-century summer precipitation in South Eastern South America: comparison of gridded and station data. Int. J. Climatol, 33: 2923-2928. doi:10.1002/joc.3633 [Paula LM Gonzalez, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, reference has been included in lines page 81, lines 16 and lines 40-45.
42668	81	16	81	17	Note that if SESA is defined as the region between 25°S-40°S and 65°W-45°W (as stated in figure 10.19) the cities of Sao Paulo and Rio de Janeiro (which are at about 22°S) are outside the SESA box. I would suggest extending the northern limit of SESA to 20°S to avoid this problem. [Claudio Guillermo Menéndez, Argentina]	Rejected: the region has been selected on basis of the region where a positive trend has been observed in available literature.
39646	81	18	81	19	Zak et al. (2008) concludes that the agricultural expansion resulted from the nolinear effects of the combination of precipitation change and variability and land use change. Zak M, Cabido M, Cáceres D, Díaz S. 2008. What drives accelerated land cover change in central Argentina? Synergistic consequences of climatic, socioeconomic, and technological factors. Environ. Manage. 42: 181–189. [Carolina Vera, Argentina]	Accepted: text has been changed and reference has been added.
39648	81	31	82	43	One missing element in discussion and in figure 10.9 is the potential role of the variability and change of SST anomalies in the tropical Pacific-Indian Oceans in explaining SESA precipitation changes. That influence has been identified in previous studies on multi-decadal timescales (Grimm and Saboia, 2015, J. of Climate, Grimm et al., 2016, Clim Res 68: 277–294, Fernandez and Rodrigues, 2018, Int. Jou. Climatology, https://doi.org/10.1002/joc.5248) including the influence of the interdecadal Pacific Oscillation (IPO). Robledo et al. (2019. Int. Jou. Climatology, submitted) show a positive trend of summer extreme precipitation in SESA in association with positive SST changes in tropical Pacific-Indian oceans. [Carolina Vera, Argentina]	Accepted: text has been re written (former p81 l47 to p82, l4), references inserted and the mechanism suggested by these papers has been included in the figure.
48994	81	40	81	41	I would suggest to add the following reference when mentioning evidences of summer precipitation increases in SESA. Rusticucci and Penalba (2000)'s work was one of the first papers that documented the interdecadal changes in summer precipitation over SESA based on observational data. Rusticucci M and Penalba O. 2000. Interdecadal changes in the precipitation seasonal cycle over Southern South America and their relationship with surface temperature. Climate Research, Vol. 16: 1–15. doi:10.3354/cr016001 [Maria Laura Bettolli, Argentina]	Accepted. Reference has been included.
44178	81	44	81	45	Year of the reference to Doyle et al.'s article should be changed to 2012 [Ramiro Saurral, Argentina]	Accepted: has been changed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39670	81	47	82	4	An assessment of the influence of global SST anomalies over precipitation variability and change in SESA precipitation is not complete without considering that associated with the Pacific-Indian Oceans. The paragraphs only address the influence of the Atlantic variability. However, many studies based on observations (e.g. those made Grimm, Nogues-Paegle and Mo, Kayano, etc.) show the dominant role of Pacific-Indian Ocenas on both interannual (e.g. ENSO) and multi-decadal timescales (e.g. IPO or PDO) over that associated with the Atlantic Ocean. Studies based on numerical simulations made by Barreiro et al. (2014, Clim Dyn (2014) 42:1733–1753 DOI 10.1007/s00382-014-2088-6) confirm the dominant influence of the Pacific SST variability with that associated with the Atlantic contributing secondary. [Carolina Vera, Argentina]	Accepted: text has been modified accordingly and references added.
39674	81	55	82	2	Provide more detail of the model/s considered in Monerie et al. (2019) [Carolina Vera, Argentina]	Accepted: details have been added to text for the SOD
21130	81				Figure 10.19: Again, the resolution of Figure 10.19 is too low. Texts are not clearly legible. [Gwenaelle GREMION, Canada]	Not applicable. Figure has been changed.
39672	82	7	82	8	Include the numbers of CMIP5 models and members considered by Vera and Diaz (2015) and Diaz and Vera (2017) [Carolina Vera, Argentina]	Accepted, number of models and members have been added.
44036	82	9	82	9	Suggest to add here: " This result is supported by a similar finding of a detectable anthropogenically forced increase in precipitation over the region (1901-2010) by Knutson and Zeng (2018) based on gridpoint scale UDA (univariate detection/attribution analysis). Their analysis compared All-forcing simulations vs. Natural-forcing simulations to infer an anthropogenic influence as the difference between the two, and thus did not attempt to attribute the precipitation trends to a specific anthropogenic forcing agent. They also find that the observed trends are significantly stronger than simulated in the CMIP5 model ensemble, even accounting for possible internal variability influence." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c; see also their supplemental material for seasonal UDA attribution results if needed). [Thomas Knutson, United States of America]	Rejected. This paper is a detection/attribution study of precipitation on the global scale and does not discuss any mechanisms/drivers for of this region, which is what the subsection is about.
44180	82	16	82	16	A paper still under review by Saurral et al. also shows the role of increasing GHG in the observed trends of precip over SESA by means of a medium-complexity global climate model [Saurral, R., F. Kucharski, and G. Raggio, 2019: Variations in ozone and greenhouse gases as drivers of Southern Hemisphere climate in a medium-complexity global climate model. Clim. Dyn., under review] [Ramiro Saurral, Argentina]	Accepted: text referring to this publication has been included.
39676	82	18	82	19	Provide more detail of the model/s considered in Gonzalez et al. (2014) [Carolina Vera, Argentina]	Not applicable. Text has been removed.
21132	82	20	82	20	Does the stratosphere vertical resolution mean resolution of climate models? [Gwenaelle GREMION, Canada]	Noted: the answer is no, one usually specify whether it is horizontal or vertical resolution. Here is even more precise as one speaks about vertical resolution in the upper atmosphere.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8878	82	40	82	42	It is incorrect to say that Gonzalez et al. 2014 'examined two forcings and found that only one of them caused the positive precipitation trend'. That article states that given the ensemble of opportunity analyzed in the study, ozone depletion seems to be the dominant forcing for the positive trend observed over the period 1960-1999, more so that GHGs increases. The paper does not state that GHGs play NO ROLE on the wetting. [Paula LM Gonzalez, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been removed.
44038	82	42	82	42	Suggest to add: "Another study attributed the increasing trends to anthropogenic forcing in general (vs. natural forcing) but did not further distinguish the type of anthropogenic forcing causing the increase (Knutson and Zeng 2018)." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 3c; see also their supplemental material for seasonal UDA attribution results if needed). [Thomas Knutson, United States of America]	Rejected. This paper is a detection/attribution study of precipitation on the global scale and does not discuss any mechanisms/drivers of this region, which is what the subsection is about.
39650	82	42	82	43	The message would be more robust if it also includes an assessment of the detection of the precipitation trend in SESA as well as the atribution assessment. Also a message could better described the fact that knowledge has been expanded regarding the drivers of SESA precipitation changes from GHG increasing and Pacific variability towards the roles of Atlantica variability and ozone depletion, but that the uncertainty about their combined contributions are still large. I suggest to read Key Message Atlas 6.1 of the ATLAS [Carolina Vera, Argentina]	Accepted: text has been changed accordingly.
21134	82	46			Section 10.4.2.2.5: There should be senteces saying that 1) most of the annual mean temperatures during the cooling ended around 2014 were higher than those before 1980 and 2) there is recent warming since the end of cooling around 2014. [Gwenaelle GREMION, Canada]	Rejected: the attribution focuses on a specific cooling period within a low-frequency anthropogenic warming trend. This is clearly indicated in the text.
30046	83	30	83	33	This section is supposed to be about Eurasian winter cooling, but winds up being almost entirely about the influence of Arctic sea-ice loss. In the spirit of this chapter, at least a proximate cause of the observed cooling in recent decades appears to be the trend of the stratospheric vortex towards a weaker state (Kretschmer et al. 2018 BAMS doi: 10.1175/BAMS-D-16-0259.1). This could just be internal variability, but it surely is part of the story. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the paper and the mechanism have been mentioned in the SOD text.
32544	83	35	83	48	I think care needs to be taken to describe whether the studies were aiming to look at past sea ice loss or future sea ice loss as they could differ. For example Zhang et al (2018) was simulating future sea ice loss but in this context it sounds like it is referring to past sea ice loss. [Isla Simpson, United States of America]	Accepted: this important precision has been added for the SOD
30038	84	10	84	35	In this discussion, it needs to be recognized that (i) absence of evidence is not evidence of absence, and (ii) models may be deficient in their representation of mechanisms, so just because a model fails to exhibit something, doesn't mean the real world doesn't. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the SOD text has been revised to acknowledge this point
30034	84	12	84	12	I don't believe that Wallace et al. (2014) is a peer-reviewed publication, rather an opinion piece, therefore it should not be referenced here. Anyway there is no need for it, because the statement is supported by the evidence provided in the rest of this paragraph. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the reference has been removed

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30036	84	27	84	32	Lead-lag relationships cannot be used to establish causality in the presence of long timescales (as is the case here). Instead, it is necessary to appropriately condition for confounding variables. This is what is done in the study of Kretschmer et al. (2016 J.Clim. doi: 10.1175/JCLI-D-15-0654.1), whose results should be discussed here. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the paper has been cited and assessed for the SOD
30040	84	50	85	4	Please read Kretschmer et al. (2016 J.Clim. doi:10.1175/JCLI-D-15-0654.1), who did use a methodology that can establish causality. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: the paper has been cited and assessed for the SOD
30042	84	53	84	54	I don't believe that Wallace et al. (2014) is a peer-reviewed publication, rather an opinion piece, therefore it should not be referenced here. Anyway there is no need for it, because there are lots of other papers being cited for this point. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the reference has been removed
30044	85	6	85	17	Zappa et al. (2018 GRL doi: 10.1002/2017GL076096) show that the equatorward North Atlantic wintertime jet shift in response to sea-ice loss is robust across the CMIP5 models. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Rejected: the case study is about summer, not winter
56498	85	28	86	6	Is this really unusual? In average, land temperature have risen considerably faster than those over sea (by about a factor 2). In addition, this statement merely looks into the summer season (which is strongly affected by the Med. Amplification). The text quickly jumps to aerosol changes. It mentions circulation changes, but they are discounted without solid evidence. The text does not mention thermodynamic theories behind the Med. Amplification (related to land-sea contrast and lapse-rate changes), and it ignores that the Mediterranean amplifcation occurs in simulations without aerosol changes (Kroner et al 2017, http://dx.doi.org/10.1007/s00382-016-3276-3; Brogli, et al. 2019, https://doi.org/10.1175/JCLI-D-18-0431.1) [Christoph Schär, Switzerland]	Noted: The text is revised. The lapse-rate mechanism is discussed and also more attention is given to potential circulation changes.
54950	85	31			Why do you call this section « Western Europe » whereas the Central Europe and the Mediterranean regions are among the hot-spots ? « Euro-Mediterranean summer warming » seems to be relevant too. [Samuel Somot, France]	Noted. The main focus is on the Western Europe. The Mediterranean is discussed in sec. 6.
54952	85	50			Nabat et al. 2014 could enter this list I would say [Samuel Somot, France]	Accepted. Reference is added
54954	85	52			Nabat et al. 2014 could also enter here. The studied period is more recent and focused on the brightening period with attribution sensitivity runs [Samuel Somot, France]	Rejected. Focus of Nabat is aerosols and is less relevant here. Nabat et al. is already referenced in the sentence above
54956	85	53			Nabat et al. 2014 attributes it mostly to the aerosol direct effect. Contradictory with Pfeifroth [Samuel Somot, France]	Accepted: Good additional information. The text has been revised
21136	85				Figure 10.21: Does the 'C' on the upper left mean that temperature's unit is Celsius? What is the unit of the SAT trends? C/year or C/decade? The resolution of the bottom plot is too low. [Gwenaelle GREMION, Canada]	Noted: New figure for Europe is produced for the SOD
51084	86	7	86	7	insert "is" before "not associated" [Bart Van den Hurk, Netherlands]	Accepted
54958	86	19			Nabat et al. 2014 have shown that a RCM driven by ERA-Int and using aerosol trend in its forcing is able to catch the shortwave and temperature trends and their spatial pattern. It also improves the Meditearrean SST trend [Samuel Somot, France]	Rejected. Nabat et al. 2014 is already referenced a few lines above.
51086	86	25	86	28	Also Atlas.5.6.2.5 pays attention to role of aerosols in European warming [Bart Van den Hurk, Netherlands]	Noted: Text has been made consistent with the Atlas
56502	86	31	86	33	It is fine to mention feedback processes, but feedbacks only amplify or weaken the signal, and cannot cause it. Before discussing the feedbacks, the drivers should be addressed [Christoph Schär, Switzerland]	Accepted. Drivers are discussed before feedbacks

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
56500	86	33	86	37	I do not trust this assessment. The argument is merely based on one modeling study, and there are are serious doubts about the indirect aerosol effects in climate models (Malavelle et al, 2017, Nature, doi: 10.1038/nature22974). I think this conclusion / assessment should be removed from the text. Again, the text ignores thermodynamic and lapse-rate changes. [Christoph Schär, Switzerland]	Taken into account: the assessments are revised based on the cited papers and other evidence.
49314	86		87		Section 10.4.2.2.7 gives a nod to the paleoclimate record of droughts in SW North America and in Central America, but this section could benefit from a fleshed-out perspective from the many paleoclimate studies that document and seek to understand past mega-droughts in this region. What do past droughts tell us about what is possible or likely in the future? [Yarrow Axford, United States of America]	Accepted : Some paleoclimate information has been added, as relevant to the discussion.
44040	87	28	87	28	Suggest to add here: "Knutson and Zeng (2018) find that the decreases in observed precipitation in the region generally are not large enough to be clearly distinguished from natural variability (that is, that the observed precipitation declines over 1901-2010, 1951-2010 are not detectable decreases). A few gridpoints were assessed as having detectable anthropogenic decreases over the recent period 1981-2010, though this finding is rather localized and not representative of the region as a whole, which has mostly nondetectable trends. Surface warming trends (Knutson et al. 2013; Fig. 10-12) were found to be detectable and attributable to anthropogenic forcing over the region on all three time scales (1901-2010; 1951-2010, and 1981-2010; " Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Figs. 3c, 4c, and 5c; see also their supplemental material for seasonal UDA attribution results if needed). Knutson, T.F. , Zeng, and A. Wittenberg (2013), Multimodel Assessment of Regional Surface Temperature Trends: CMIP3 and CMIP5 Twentieth-Century Simulations. J. Climate, v. 26, pp. 8709-8743 (see Figs. 10-12). [Thomas Knutson, United States of America]	Accepted: Paper is cited as part of the discussion about natural variability and occurrence of drought in this region.
51088	87	31	87	33	Puzzling conclusion: I would expect that observed records are affected by dynamical variability as well, and thus that removing this dynamical variability would reduce correspondence between modelled and observed records [Bart Van den Hurk, Netherlands]	Rejected : The methodology attempts to distinguish between thermodynamic and dynamic influences on a regional change in both observations and models. As the dynamical contribution is almost all internal (and thus very likely very different between model and observation), removing it brings observations and models closer.
32546	87	38	87	39	This statement seems at odds with the way Seager and Hoerling (2014) is described above. It sounds like Seager and Hoerling argue that the ocean forced component alone is insufficient and that atmospheric variability has to be invoked as well. Should this statement perhaps then be changed to “There is high confidence that SOME PORTION of the anomalous atmospheric circulation that caused the SWN...”? [Isla Simpson, United States of America]	Accepted. The statement has been revised for the SOD to recognized that an important portion of the precipitation trend is linked to tropical Pacific SST variations related to PDV.
33338	87	38	87	40	Not clear what the "high confidence" for this attribution is based on. Just the two cited Seager studies? [Erika Wise, United States of America]	Noted: The high confidence is based on multiple studies by multiple authors that are assessed in the discussion on tropical SST influences.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7696	87	44	87	50	The use of different term for the mid-summer drought in the Caribbean is confusing (mid-summer drought , mid summer drying) and then the term summer drought. Could the summer author clarify what is meant by summer drought (Does it mean drying of the wet season?) [isabelle gouirand, Barbados]	Taken into account: text revised to indicate the terms mid-summer drought and mid-summer drying are interchangeable. The months used to define summer drought in some studies are indicated in the original text to suggest that the months identified overlap with months associated with the mid-summer drought.
7698	87	44	87	50	The African Easterly waves could be mentioned as they play a part in the Caribbean rainfall independantly from tropical depression, and stroms although the storms develop sometimes in conjonction with the passage of an African Easterly wave [isabelle gouirand, Barbados]	Response: Noted. Easterly waves are referred to in revised text.
7700	87	44	88	50	The subsection relative to the Caribbean islands summer drought is ambiguous and could mislead the reader. The first paragraph (line 45-50) mentioned most of the drivers of the Caribbean rainy season or at least related to precipitation over the Caribbean. However, the following paragraphs focus on the mid-summer drought, hence on June, July and August as summer months. Nevertheless, June-August only represent a section of the rainy (wet) season that spans from June to October-November. Based on this the reader could think that the Caribbean rainy season (from October to March) is getting drier. However, Mendez-Lazarro et al 2019 also shown in their Table 4 that two stations out of four in Puerto Rico have a positive trend in rainfall in Sept-Nov. Is the rainfall in Sept-Nov lower than the reduced amount of rainfall in July-Aug? A sentence could be added regarding this question and reduce the ambiguity regarding an intensification of the mid-summer drought versus a drying of the entire wet season (May-October). The cited work from Herrera et al 2018 (line 44) mentioned a pan-Caribbean drought from 2013-2016 and thus suggesting a period of three years with reduced rainfall covering both the dry and wet season in the Caribbean. This refers to a drought that occurred on a different time scale than the mid-summer drought (that is not a drought but a reduced amount of rainfall during the rainy season). Could the author add a sentence showing why it is important to mention that three years drought? [isabelle gouirand, Barbados]	Rejected: the text does not suggest a drying of the entire rainfall season. While the opening statements indicates some of the drivers of Caribbean rainfall in general, an assessment is presented specifically for the JHA season. Text also suggests that the drying is not reflected for all stations as noted for Puerto Rico.
7706	87	54	87	54	Not all the studies agreed on the regional distribution of the MSD (summarized in the introduction of Martinez et al 2019). The author could add that Taylor and Alfaro 2005 described an unimodal pattern of rainfall over the Eastern Caribbean while Martinez et al 2019 found that the MDD extends over the whole cariibean region. Martinez et al (2019) is already in the reference list. The additional references will point out that not all studies agreed on the regional distribution of the mid summer drought accross the Caribbean region. [isabelle gouirand, Barbados]	Noted: the text does not suggest that northern/western Caribbean is the only area that the mid-summer drought is evident.
48068	88	6	88	6	In several places along the chapter, the text makes reference to statistically significant results, but no information about the level of significance is given. [WGI TSU, France]	Accepted: significance level is now indicated.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44042	88	7	88	7	Suggest to add: "Knutson and Zeng (2018) using gridpoint based UDA analysis, show results indicating detectable anthropogenically forced decreasing precipitation trends over 1901-2010 for some gridboxes in the general region of the Caribbean, including south of Cuba, in the northern Bahamas, and in the Windward Islands. These findings did not hold over the shorter time intervals they analyzed (1951-2010 and 1981-2010). UDA also indicates detectable anthropogenic warming in the region since 1901 (Knutson et al. 2013)." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Figs. 3c, 4c, and 5c; see also their supplemental material fo r seasonal UDA attribution results if needed). Knutson, T.F. , Zeng, and A. Wittenberg (2013), Multimodel Assessment of Regional Surface Temperature Trends: CMIP3 and CMIP5 Twentieth-Century Simulations. J. Climate, v. 26, pp. 8709-8743 (see Fig. 10). [Thomas Knutson, United States of America]	Accepted: text has been revised to include results of the suggested paper
7712	88	16	88	16	The text that references the Figure 10.22 supports an intensification of the mid-summer drought but the caption of the figure 10.22 refers to " Influences that have been suggested to contribute to an intensification of June-August rainfall over the Caribbean". As the figure is not visible (the box could be enlarged) it is difficult to say if there is an error in the caption although it is suspected that the caption should be "an intensification of the drying" to be coherent with the text. [isabelle gouirand, Barbados]	Not Applicable: figure has been completely revised for the SOD.
7704	88	17	88	17	"some" northern Caribbean Station could be replaced by "six" as six stations are presented in the figure10.22 [isabelle gouirand, Barbados]	Not Applicable: figure has been completely revised for the SOD.
43170	88	33	88	36	Warming over the tropical north atlantic may drive a stronger NASH, but it's greater warming in the tropical north pacific relative to the tropical north atlantic that would drive a stronger future CLLJ and therefore more drying (not just a warmer atlantic as this sentence suggests). (Like ENSO modulation. Thus, this could be driven by increasing El Nino like conditions. And/or increased easterlies.) This sentence should be expanded to better explain the connection with the CLLJ and drying. An increase in the strength of the CLLJ has been projected in regional climate model simulations: Franco-Fuentes et al. 2015 (https://doi.org/10.1007/s00382-014-2258-6), Taylor et al. 2013 (DOI: 10.1002/joc.3461), Similarly, Jones et al. 2016 (http://dx.doi.org/10.1002/2015JD024342) looked at a future, stronger CLLJ and its relationship to tropical cyclones (statistical downscaling). [Melissa Bukovsky, United States of America]	Accepted: text has been revised to reflect that the influences of both Atlantic and Pacific oceans are important to summer rainfall trends.
7702	88	49	88	50	The statement is misleading as it is suggesting that the possibility of a drying trend over the Caribbean, even with low agreement, as the whole sub-section focused on the summer drought only. The authors could clarify the statement by mentioning "the drying trend in summer" [isabelle gouirand, Barbados]	Accepted: text has been revised.
48116	88		90		10.4.2.2.9 and 11.9.2 both cover urban heat island effect including heat and precip extremes. Additionally, section 8.2.2.2.7 discusses direct anthropoengic influence on the water cycle (precipitation modification). Please ensure correct cross-references where appropriate and minimise overlaps where possible. [WGI TSU, France]	Taken into account: we will check consistency across chapters concerning urban climate matters and put the revised text in the urban climate box for the FGD.
21138	88				Figure 10.22: North Atlantic High should be North Atlantic Subtropical high for consistency with the manuscript. [Gwenaelle GREMION, Canada]	Not Applicable: figure has been completely revised for the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48818	89	2			"where urban air temperatures are substantially higher": substitute by “can be”, depending on multiple factors [António Lopes, Portugal]	Rejected: this is the definition of the UHI. The word “can” can not be used with the affirmative style of the sentence. Of course the UHI depends on different parameters and can be even negative in some conditions.
51090	89	6	89	6	phenomenon -> phenomena [Bart Van den Hurk, Netherlands]	Accepted
48812	89	9			PCI (park cool Island, or less common negative heat island) should be mentioned and explained as a major source of tackle urban heat. Generally green areas explain it and can be introduce in the text [António Lopes, Portugal]	Noted: studies about the UHI mitigation/adaptation including the use of green/bleu areas will be discussed in details in the WG2 report chapter6 (cities settlements and key infrastructure). This case study about cities will be converted into a box and there is no room for any further additions. Will make sure to do the handshake with WG2.
51092	89	23	89	23	wouldn't it be better to first discuss the observations and subsequently the model results? [Bart Van den Hurk, Netherlands]	Noted: the logic is to discuss global then regional aspect.
51094	89	35	89	42	I am not sure whether it is really relevant to express the fraction of the temperature trend attributed to UHI for the aggregation level of a continent. Global and city level I can understand, but anything in between is pretty arbitrary and depends a lot on the population density of the area of interest [Bart Van den Hurk, Netherlands]	Noted, this has not been implemented in the SOD but will be in the FGD
32548	89	38	89	38	Global warming in Brussels doesn’t make a lot of sense. Should it just be warming? Not global warming? [Isla Simpson, United States of America]	Accepted: the text has been revised (global has been removed).

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
7472	89	42			Urbanization is important issue in Korea, so the quantitative impact on long tern temperature trends becomes hot issue. Recently, Park et al (2017) updated anthropogenic warming in Korea and showed contribution of urbanization is sentitive to methods between “cty minus rural” and “observation minus reanalysis” and analysis period as well; “results from “city minus rural” methods showed that 30–45% of the local warming trends during recent four decades are likely due to the urbanization effect, depending on station classification methods and analysis periods. Results from an “observation minus reanalysis” method using the Twentieth Century Reanalysis (20CR) data sets (v2 and v2c) indicated about 25–30% contribution of the urbanization effect to the local warming trend during the recent six decades. However, the urbanization contribution was estimated as low as 3–11% when considering the century-long period. Our results confirm large uncertainties in the estimation of urbanization contribution when using shorter-term periods and suggest that the urbanization contribution to the century-long warming trends could be much lower.” Therefore I recommend to mention sensitivity at the of this paragraph as following; “ There are large uncertainties in the estimation of urbanization contribution. By definition method, contribution ranges from 25 to 45%. Century-long term trends from shorter scale could be lower below 11% (Park et al., 2017)” reference) Bo-Joung Park, Yeon-Hee Kim, Seung-Ki Min, Maeng-Ki Kim, Youngeun Choi, Kyung-On Boo, Sungbo Shim 2017: Long-term warming trends in Korea and contribution of urbanization: An updated asessment, JGR Atmosphere, doi:10.1002/2017JD027167 [Kyung-On Boo, Republic of Korea]	Taken into account: reference has been added in the text. It is trivial that if you look at century time scale the urbanization effect will be smaller since the accelerating trend of urbanization has happened since 1950 but indeed different contribution methods could give different results.
48820	89	42			Please include one paragraph explaining that many meteorological stations have been surrounded by buildings in the last years and can now measure the urban signal and not the regional climate signal [António Lopes, Portugal]	Noted: the discussion about the station surrounding and environment comes just after this paragraph.
21140	89				Figure 10.23: What is the time period? Also there are no time series plots. [Gwenaelle GREMION, Canada]	Taken into account: a new version of this figure is being done for the SOD
51096	90	19	90	19	example -> examples [Bart Van den Hurk, Netherlands]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21142	90	38	90	40	Please consider to include an assesment on the urban dry island as well (possibly indicating that only limited knowledge available on change of urban dry island under climate change?) . Literature e.g.: Robaa, S.M., 2003. Urban-suburban/rural differences over Greater Cairo, Egypt. Atmósfera, 16(3), pp.157-171. Tapper, N.J., 1990. Urban influences on boundary layer temperature and humidity: results from Christchurch, New Zealand. Atmospheric Environment. Part B. Urban Atmosphere, 24(1), pp.19-27. Unger, J., 1999. Urban–rural air humidity differences in Szeged, Hungary. International Journal of Climatology, 19(13), pp.1509-1515. Jáuregui, E. and Tejeda, A., 1997. Urban–rural humidity contrasts in Mexico City. International Journal of Climatology, 17(2), pp.187-196 Kuttler, W., Weber, S., Schonnefeld, J. and Hesselschwerdt, A., 2007. Urban/rural atmospheric water vapour pressure differences and urban moisture excess in Krefeld, Germany. International Journal of Climatology: A Journal of the Royal Meteorological Society, 27(14), pp.2005-2015. Lokoshchenko, M.A., 2017. Urban heat island and urban dry island in Moscow and their centennial changes. Journal of Applied Meteorology and Climatology, 56(10), pp.2729-2745. Unkašević, M., Jovanović, O. and Popović, T., 2001. Urban-suburban/rural vapour pressure and relative humidity differences at fixed hours over the area of Belgrade city. Theoretical and Applied Climatology, 68(1-2), pp.67-73 [Gwenaelle GREMION, Canada]	Taken into account: the urban dry island is discussed in the beginning of this section (briefly, due to length limitations) and the suggested references have been added in the SOD.
48324	90	50	90	50	Suggest this material is more relevant in the Atlas (as with my previous comments on earlier 10.4.2.2.x subsections unless you want to keep a second example in 10.4.2.2 to go with one "regional" example as I suggest in my comment on 75/18. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted: after discussion at LAM3, chapter 10 keeps the attribution part and the projection for each case study has been merged in the Atlas. The definition of attribution as defined in section 4 is included in the cross-chapter box on detection and attribution.
43450	90		90		50 10.4.2.2.10 Mountains: Himalayas - this section refers to the Himalayas as though they are only in South Asia; this mountain range spans Pakistan, India, Bhutan, Nepal and China. This should be noted to avoid confusion. [Saad Amer, United States of America]	Taken into account: the geographical extent of the region has been redefined, see the new Himalayas box in the SOD.
51098	91	3	91	3	Summer cooling is an interesting finding. What is the (suggested) cause of this cooling? [Bart Van den Hurk, Netherlands]	Taken into account: we searched for relevant paper and found that there were not relevant literature about the cause of the cooling in western Himalayas.
51100	91	5	91	20	These studies are all relevant and need to be included, but the collection of results is so diverse that it is difficult to read an assessment in this section [Bart Van den Hurk, Netherlands]	Taken into account: the text has been revised for the SOD
51104	91	24	91	36	"black carbon" is mentioned in this figure. I guess "black carbon deposition" is meant [Bart Van den Hurk, Netherlands]	Noted: black carbon aerosols here means the compound effect of "black carbon emission" (direct radiative effect) and "black carbon deposition" (snow darkening).
52304	91	55	91	55	Hyphen missing in "early spring". [Sergio Henrique Faria, Spain]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32550	92	1	92	1	This seems at odds with Hunt et al (2019) doi: 10.1175/JCLI-D-18-0601.1 which argues that WD activity is expected to decline under RCP8.5. Perhaps this discrepancy needs to be discussed. [Isla Simpson, United States of America]	Taken into account: we have add this paper and discuss its relevance in the SOD.
32552	92	10	92	11	This doesn't seem like an attribution statement because the weakening of the South Asian monsoon hasn't been attributed to something and reduced summer precipitation and weakened Asian monsoon sounds like they are one and the same. Perhaps this could be re-worded to "...summer precipitation was associated with a weakening of the South Asian monson..." [Isla Simpson, United States of America]	Taken into account: we have added this paper and discuss its relevance in the SOD.
21144	92	10	92	11	High confidence for the summer precipitation is somewhat questionable because there are studies showing the opposite precipitation trend over the western Himalayas in Line 14-20 of Page 91. [Gwenaelle GREMION, Canada]	Accepted: text has been revised for the SOD
54564	92	22	92	24	regional climate projections are often deemed unreliable' ..... This is a storng statement. What is the evidence for this, and what do you mean by often? Also this is not considering the different protocols of decision making under uncertainty. This latter effects how reliable the projections 'need' to be. [Linda Mearns, United States of America]	Accepted : the statement has been modified for the SOD and is now much softer
51106	92	23	92	24	This is a way too generic statement and not true in many examples of regional climate assessment; see sectio Atlas 5.6 where in Europe a lot of climate assessments based on CORDEX are discussed. The fact that there is substantial spread in the projections does not mean that they are unreliable for adaptation decision support; this uncertainty is an inherent ingredient in the adaptation policies [Bart Van den Hurk, Netherlands]	Accepted : the statement has been modified for the SOD and is now much softer
41396	92	29			If this section focusses on the 'latter' (predictability of internal variability?) are the other two dealt with elsewhere? They seem rather important. A cross-reference would suffice. [Debra Roberts, South Africa]	Noted: the other sources of uncertainty are discussed in chapter 4. A reference has been made to the appropriate chapter 4 section for the SOD.
51108	92	33	92	33	possible -> possibly [Bart Van den Hurk, Netherlands]	Accepted
51114	92	39	#REF!	39	some notion or definition of the time scale of internal variability may be necessary. In the tropics ENSO gives large internal variability at the time scales of a few years, while in the extra-tropics synoptic variability gives internal variability at time scales of about a week [Bart Van den Hurk, Netherlands]	Taken into account: the time scales of internal variability have been briefly introduced for the SOD
51110	92	43	#REF!	43	stronger -> strongest [Bart Van den Hurk, Netherlands]	Accepted
51112	92	44	#REF!	44	decrease -> decreases [Bart Van den Hurk, Netherlands]	Accepted
21146	92	51	92	52	"Based on a 40-member ensemble": It is not clear from which models is a 40-member ensembel. [Gwenaelle GREMION, Canada]	Taken into account: we are talking here of 40 realizations or members from a single model (the CCSM3 NCAR model). The sentence has been modified to make it clear and now reads as: "based on a 40-member ensemble from a single climate model". However we do not think it is needed to add the model acronym, the interested reader can find it in the referenced paper.
48424	92		106		It would be nice to always have a brief description of what was assessed in AR5 and SRES whenever possible. That will also encourage an assessment of more recent literatures (post AR5). [Rondrotiana Barimalala, South Africa]	Not applicable: the AR5 assessment has been briefly discussed in the revised version for the SOD to the Atlas

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51116	93	1	#REF!	1	if this is done for the 2050's, some assumed warming rate/emission scenario needs to be assumed. This applies to RCP8.5 type emission scenario, I assume? [Bart Van den Hurk, Netherlands]	Noted: the GES scenario is given two lines above.
21150	93	4	93	4	How is a "low" SNR defined? Unclear! [Gwenaelle GREMION, Canada]	Taken into account: this has been defined more precisely for the SOD
30048	93	14	93	17	Statistical significance is not the appropriate issue here. It is statistical detectability. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the text has been revised for the SOD
21152	93	14	93	19	"Results indicate that regional precipitattion trends "may" remin statistically insignificant ….", and the conclusion "there is "high confidence" that internal variability will significantly influence future regional precipitation trends". These two sentences seem to contradict each other. [Gwenaelle GREMION, Canada]	Accepted: the text has been revised for the SOD. In fact, it is not about statistical significance but statistical detectability (has the forced response robustly emerged from the noise ?)
7470	93	17			Time of emergence is important for adaptation and decision making priority. So in Korea there was domestic study applying AR5 method(Mahlstein et al., 2011), because we want to know what season is effective for mitigation and urgent for adaptation. Boo et al (2016), even though it is in Korean, reported that “Significant emergence in JJA is expected to appear in 2030s in three RCP scenarios, earlier than TOE in DJF. In DJF, TOE is expected to be 2040s in RCP 8.5 and is delayed in 2060s, 2080s in RCP4.5, 2.6, respectively. Later emergence in low emission scenarios implies an importance of climate change mitigation consistent with previous studies.” Therefore I suggest to add implification of seasonality of TOE at the end of this paragraph as the followings; “Affected by the amplitude of natural variability, TOE in JJA is earlier than in DJF, implying climate change adaption should be prepared in summer than in winter. Also, TOE in winter is delayed in reduced emission scenarios, reflecting climate change mitigation is effective in winter than in summer(Boo et al., 2016)” Reference) Boo, Kyung-On, Sungbo Shim, Jee-Eun Ki,, Young-Hwa Byun, ChunHo Cho, 2016: Emergence of anthropogenic warming over South Korea in CMIP5 Proejctions, Journal of Climate Change Research, Vol7, 421-426 DOI: http://dx.doi.org/10.15531/KSCCR.2016.7.4.421 (In Korean) [Kyung-On Boo, Republic of Korea]	Noted: this subsection focuses on global results and does not focus on local to sub-regional studies of time of emergence
21148	93	25	20	106	Would it be possible to merge the case-studies instead of repeating the case-studies again, but from a different angle? This could provide a clearer structure and more compelling case-study at once, instead of going to different sections throughout the chapter to understand a case-study. [Gwenaelle GREMION, Canada]	Not applicable: the future projection part has been removed (see the Atlas for future changes).
48326	93	25	93	26	As with my comments on the previous subsections, maybe much of te material in this subsection (suitably shortened) would be more relevant in the Atlas. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted: most of the material has indeed been moved to the Atlas.
54960	93	25			I would say that an oceanic case study is missing. The Mediterranean Sea would be a good case as a number of model runs and articles is now available in the framework of Med-CORDEX. The Baltic Sea could be another option. [Samuel Somot, France]	Not applicable: the future projection part has been removed (see the Atlas for future changes).
21154	93	30	93	30	"Even if successful". It is unclear what "successful" refers to. Does it mean if we overcome the challenges? [Gwenaelle GREMION, Canada]	Accepted: this has been removed from the text

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
29522	93	31	93	33	I think here it is important to include a statement that internal variability modes can be modulated by external drivers as demonstrated for the solar forcing (Thieblemont et al., 2015)! This plays a role in particular on the decadal timescale for near-term climate predictions and is therefore highly relevant. Thiéblemont, R., K. Matthes, N. Omrani, K. Kodera, and F. Hansen (2015), Solar forcing synchronizes decadal North Atlantic climate variability, Nat. Comm., 6, doi: 10.1038/ncomms9268. [Katja Matthes, Germany]	Taken into account: the text has been revised and reference added to illustrate the point
44044	93	41	93	43	Comment: the quantitative penalty paid by using smaller ensembles to estimate the ensemble mean, combined with large samples of internal variability from control runs vs. using large ensemble sizes of single models is not clear and is probably region and variable dependent. For a contrary view to Dai and Bloecker, see Thompson et al. 2015) who infer that for many cases results that large ensembles provide little information on the role of internal variability in future climate that cannot be inferred from the statistics of an unforced control simulation. Reference: Thompson, D. W. J., E. A. Barnes, C. Deser, W. E. Foust, and A. S. Phillips, 2015: Quantifying the role of internal climate variability in future climate trends. J. Climate, 28, 6443-6456. [Thomas Knutson, United States of America]	Noted: In the Thompson et al. method, there is the assumption that internal variability does not change under external forcing (from the abstract: assumes that the statistics of the internal variability are roughly Gaussian and stationary in time). There is a lot of evidence showing that these assumptions are questionable, see for instance Lajoie et Delsole (reference has been added for the SOD)
21156	93	49	93	49	"Models" do not reliably project future climate in the Sahel. Does it mean all kinds of model can not simulate the future climate in the Sahel well? Please provide reasons explaning why. (For GCMs and RCMs could be different reasons, respectively) [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
30050	93	51	93	52	Isn't it obvious (and trivial) that the forced response will depend on the forcing scenario? [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: Text has been removed.
49316	93		95		Section 10.4.3.2.1 on the Sahel briefly mentions paleoclimate evidence for very different conditions in the mid-Holocene, which is useful. “In drawing comparisons with paleo-climates such as the mid-Holocene, in which vegetation existed much further north, Schewe and Levermann (2017) suggested that the Sahel is capable of abrupt climatic shifts in response to gradual forcing.” However, there is an extensive literature on this especially remarkable transition in the Holocene Earth system. Additional citations and discussion seem warranted here. [Yarrow Axford, United States of America]	Not applicable: Text has been removed.
54160	94	3	94	3	Before "The CESM1 model appears…". I suggest to add: "Diedhiou et al.(2018) using 84 ensemble (r1i1p1) members of the 4 RCPs (1961–2099) noted that over West and Central Africa, while there are several uncertainties and large ensemble spread in the projections of precipitation, most models show that precipitation and soil moisture anomalies have the highest probability to increase in the Central Sahel. Over the wetter regions of the Guinea Coast and Central Africa, models project a weak change in total precipitation and a decrease of the length of wet spells. West of Western Sahel is projected by 80% of the models to experience the strongest drying with a significant increase in the length of dry spells". Référence : Diedhiou A. et al., (2018). Changes in climate extremes over West and Central Africa at 1.5 C and 2 C global warming. Environmental Research Letters, 13(6), 065020. [ARONA DIEDHIOU, Cote d'Ivoire]	Not applicable: Text has been removed.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21160	94	9	95	12	Page 95 Line 12 the conclusion mentioned: "There is medium confidence that in future climate scenarios dominated by greenhouse gas forcing the West African Monsoon and Sahel rainfall will increase." medium confidence does not sound very convincing after read the previous studies which mentioned on the previous page (page 94). There is NOTHING mentioned to support medium evidence. Page 94: line 9: Monerie et al. (2017a) analysed 32 CMIP5 models under the RCP8.5 emission scenario.... Four groups are found that do not even agree on the sign of future Sahel precipitation change. Line 23: Erfanian et al. (2016) using a single RCM ensemble driven by historical and RCP8.5 scenarios from four GCMs....The RCM future trends were more consistent than the contradicting GCM ones and showed decreased rain over significant portions of West Africa. Line 33: Akinsanola and Zhou (2018) showed reductions in wet-day rainfall for 2070–2099 in RCP4.5 and RCP8.5 scenarios. While wet days will become more intense, the tendency for a reduced number of wet days reduces overall rainfall. Line 44: Giannini and Kaplan (2018)...such that the sum of tropical and North Atlantic warming controls the Sahel rainfall increase, given that North Atlantic anthropogenic aerosol forcing is largely absent in the long-term for the RCP scenarios. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
44046	94	14	94	14	Suggest to add: "A gridpoint-based trend analysis (Knutson and Zeng 2018) finds that even though the observed trends in precipitation in the region tend to be negative and generally significant over 1951-2010, the CMIP5 ensemble mean trend is positive over the region for the 10 models they analyzed over this period." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (See Fig. 4c; see also their supplemental material for seasonal UDA attribution results if needed). [Thomas Knutson, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21158	94	30	94	31	"At the middle and end of the 21st century, summer rainfall is projected to increase over most of the Sahel, resulting from increased rainfall intensity." It is clear that rainfall will increase if the intensity increases, but it is not explained why the intensity will increase in the future. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
45092	94	34	94	36	Ozturk et al 2018 using RegCM with two different GCMs and two RCP scenarios found that there will be significant drying in the Sahel region. T. Ozturk, M. T. Turp, M. Turkes, and M. L. Kurnaz, “Future Projections of Temperature and Precipitation Climatology for CORDEX-MENA Domain Using RegCM4.4”, Atmospheric Research 206, 87-107 (2018). [Levent Kurnaz, Turkey]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
50110	95	15	96	9	The conclusion that, with a high confidence, the EASM precipitation will increase during the 21st century, may have high uncertainty instead of confidence. This is due to the moisture process over the East Asin is always uncertain and less understanding, which would be more complex in future. [Hong-Li Ren, China]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8276	95	15	96	10	Please add more information, such as Guo Xiaojun, Jianbin Huang, Yong Luo, Zongci Zhao and Ying Xu, 2016, Projection of heat waves over China for eight different global warming targets using 12 CMIP5 models, Theor. Appl. Climatol., doi: 10.1007/s00704-015-1718-1; Guo X.J., Huang J.B., Luo, Y., Zhao Z.C. and Xu, Y., 2016, Projection of precipitation extremes for eight global warming targets by 17 CMIP5 models, Nat Hazards, doi: 10.1007/s1 1069-016-2553-0 [Zong Ci Zhao, China]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21188	95	16	95	16	Section 10.4.3.2.2: EASM the acronym is not clearly defined. Please check this out. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
26556	95	17	95	20	The word "mainly due to" may be "due to both" because those two terms are all of the moisture budget equation. [Tomoaki Ose, Japan]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
26558	95	20	95	21	" (Zhou et al., 2018b) reported that the dominant source of uncertainty in EASM precipitation changes among 18 CMIP5 models is due to uncertain atmospheric circulation changes." can be changed as "Zhou et al. (2018b) reported that the dominant source of uncertainty in EASM precipitation changes among 18 CMIP5 models is due to uncertain atmospheric circulation changes. Ose (2019) also reported based on the analysis of three high-resolution MRI-AGCMs with different cumulus schemes that characteristically similar but slighly model-dependent atmospheric circulation changes can make a large uncertainty in EASM monthly precipitation changes in North Pacific East Asia so that monthly precipitation is not necessarily increased regionally in the future." (Reference) Ose, T. (2019) Characteristics of future changes in summertime East Asian monthly precipitation in MRI-AGCM global warming experiments. J. Meteor. Soc. Japan, 97, 317-335. doi:10.2151/jmsj.2019-018. [Tomoaki Ose, Japan]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21162	95	22	95	23	What does the major EASM domain refer? [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
26560	95	25	95	29	I agreed with the following description on land warming effect. "The increase of summertime land-sea thermal contrast during the positive phase of the PDV over the northeastern part of East Asia is commonly found in general circulation models regardless of future forcing scenarios, indicating the robustness of the strengthened EASM response to global warming, and the increasing contrast can be explained by GHG-induced continental warming (Kamae et al., 2014a, 2014b)." I like to add the comment on ocean warming effect. "Endo et al. (2018) showed that the northwesterly wind change over the North Pacific East Asia in the CMIP5 global warming response is due to the SST warming while the land warming causes intensified southwesterly wind over the continental region in East Asia. The northwesterly wind change over the North Pacific indicates weaken monsoon flow over the regions. The similar projection in the North Pacific is found in many CMIP3 global warming experiments (Endo 2012) and understood as the appearance of negative Pacific-Japan modes caused by the suppressed vetical motion in the subtropical Pacific (Kosaka and Nakamura 2011). Projection of precipitation in the high resolution MRI-AGCM experiments is consistent with the future changes in East Asian monsoon flows. Increase in precipitation is enhanced by intensified southerly flows over the continental region in East Asia but a large uncertainty is left in the projection of precipitation over the North Pacific East Asia due to the effect of northerly downward motion change on future precipitation (Ose 2019). (References) Endo, H. (2012) Future changes of Yamase bringing unsusually cold summers over Northeastern Japan in CMIP3 multi-models. J. Meteor. Soc. Japan, 90A, 123-136, DOI:10.2151/jmsj.2012-A06. Endo, H., A. Kitoh, and H. Ueda (2018) A unique feature of the Asian summer monsoon response to global warming: the role of different land-sea thermal contrast change	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21164	95	34	9	35	Is this conclusion "In future scenarios, the effects of the warming trend due to the increased GHG will overcome other effects (i.e. internal variability)" supported by any references? [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21166	95	43	95	45	It is unclear why the experiment setting or the future is "with decreased precipitation over the Meiyu belt and enhanced rainfall to its north and south in June and July" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21190	95	47	95	47	Section 10.4.3.2.2: Please change “Regional downscaling using dynamical models can also give indications...” by “Dynamical downscaling using regional climate models can also give indications...” [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43392	95	47	96	5	Meteorological Research Institute in Japan has conducted many studies of dynamical downscaling with own high-resolution AGCM-RCM system for a long time. Their research activities are summarized in Kitoh et al. (2016, doi:10.2151/jmsj.2015-022) and Kitoh (2017, doi:10.2151/jmsj.2017-002). I think some results should be cited here. [Hirokazu Endo, Japan]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
32554	96	7	96	8	I don't think the statement that precipitation will increase during the 21st century due to the change in moisture budget is useful. Of course it has to be that way. I think it can be stated more specifically based on the previous text that it will be due to the increased capacity of the atmosphere to hold water vapor and transport it i.e., wet-get-wetter. [Isla Simpson, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
44048	96	7	96	9	Comment: It is surprising that the authors go with high confidence for EASM rainfall even though there are barely any detectable positive anthopogenically forced trends in the region according to gridpoint based UDA analysis (e.g., Knutson and Zeng 2018; See their Figs. 3, 4, 5, and supplemental material). You may want to reconsider this high confidence level given such limited support for detectable increase in the past data. Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 [Thomas Knutson, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51118	96	26	#REF!	27	How can the RCMs be more consistent than the GCMs? Because the GCM selected were very consistent? [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
32556	96	32	96	32	The statement "constraining the wet end of precipitation projections" is unclear. Constraining it in what way? Suggest clarification. [Isla Simpson, United States of America]	Not applicable: this text has been removed. Future climate projections are no longer included in section (10.4) of chapter 10 (they can be found in the Atlas).
51120	96	35	#REF!	36	It would be good to also include the (wetter) summer trend in this statement, and if possible also the all-year precipitation trend [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
32558	96	35	96	36	Why is there no mention of the summer wetting in this averall statement? [Isla Simpson, United States of America]	Not applicable: this text has been removed. Future climate projections are no longer included in section (10.4) of chapter 10 (they can be found in the Atlas).
48634	96	39	97	43	Elements of the assessment of precipitation changes (AR5 CMIP5) discussion in 10.4.3.2.4 overlap with out South America subsection in Atlas [Lincoln Alves, Brazil]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
28938	96	47	96	47	It's not right just to pick out Strahan & Douglass as a single reference. You should list the other references in table 4-1 of the WMO 2018 Ozone Assessment, or better, cite Chapter 4 Langematz et al [Matt Tully, Australia]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
30052	96	47	96	48	I thought that in most cases, the summertime trends induced by ozone recovery are largely if not entirely offset by the opposing trends from GHG increase, so the net effect is generally neutral. Remember that the ozone recovery process is much slower than the ozone hole development. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
42672	97	14	97	22	Land surface-atmosphere interaction should be mentioned among the processes that could affect changes in precipitation in SESA. In this respect, it is interesting to note that Ruscica et al. (2016), based on an analysis of an ensemble of simulations carried out with regional models, find that the changes in precipitation in the SESA-SACZ dipole would be amplified by positive land-atmosphere feedbacks. Ruscica et al. (2016): Land surface–atmosphere interaction in future South American climate using a multi-model ensemble. Atmospheric Science Letters, doi 10.1002/asl.635 [Claudio Guillermo Menéndez, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
49002	97	24	97	43	I would suggest to add more results in the paragraph when discussing future precipitation projections in SESA. In line with Nguyen et al (2018), Maenza et al (2017) found that future projections under the most severe scenario indicate a linear increase in precipitation for wet season (September to April) over southern SESA, roughly about 15%, emerging from the multidecadal variability by along the 21st century. Their results show that the future climate over the region would be slightly wetter than the present climate, which is one already wet and which has been characterized by a significant interdecadal fluctuations. It is in such a context of a regional climate wetter than the present conditions in which Penalba and Rivera (2013) further found that droughts would be more frequent by the end of the 21st century, with shorter durations and greater severities over much of southern South America. In this sense, the long-term fluctuations from wet to dry conditions associated with the multidecadal variability projected for SESA precipitation would be a significant impact factor on society and regional economies added to the increment in the mean precipitation itself. Maenza R, Agosta Scarel EA, Bettolli ML. 2017. Climate change and precipitation variability over the western “Pampas” in Argentina. International Journal of Climatology 37: 445–463. doi: 10.1002/joc.5014 Penalba OC, Rivera JA. 2013. Future changes in drought characteristics over Southern South America projected by a CMIP5 multi-model ensemble. Am. J. Clim. Change 2: 173–182, doi: 10.4236/ajcc.2013.23017. [Maria Laura Bettolli, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21184	97	28	97	28	Section 10.4.3.2.4: Please change “…substantially less that for their identified hotspot regions.” by “…substantially less than for their identified hotspot regions.” [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51122	97	35	#REF!	35	though -> those [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
42670	97	39	97	43	Regarding uncertainty in future wetting at SESA, I would have liked to see some statement regarding the combined changes in precipitation, evapotranspiration and atmospheric demand, as discussed for example in Zaninelli et al. (2019, Clim.Dyn., https://doi.org/10.1007/s00382-018-4225-0) [Claudio Guillermo Menéndez, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
39678	97	40	97	40	"Higher uncertainty" does not seem to be the proper assessment conclusion. There is more knowledge than in AR5 about the drivers of SESA precipitation change but there is large uncertainty about their projected combined contribution. [Carolina Vera, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
39654	97	40	97	43	It would be desirable if this assessment of the projected changes is expanded in the SOD including CMIP6 derived information [Carolina Vera, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
39652	97	40	97	54	As in section 10.4.2.2.4, the assessment of the potential role of variability and change of SST anomalies in the tropical Pacific-Indian Oceans on precipitation in SESA is missing. The assessment is given too much emphasis to the AMV influence considering that many different articles show that it is secondary as compared to that associated with the Pacific-Indian Oceans [Carolina Vera, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
39680	97	41	97	41	If "more likely than not" results from an assessment, it should be in italics. Nevertheless, it is not clear how that likelihood scale was obtained. Considering that the set of CMIP5 models assessed in AR5 as well as most of model assessment resulted from the literature, project a positive precipitation trend in SESA, and that many of those CMIP5 models include chemistry-climate models as well as considering different GHG increasing scenarios, it seems that it would be possible to discriminate the assessment in the probability that the SESA precipitation will continue increasing in the future from the assessment of the magnitude of the future change that seems to be associated with large uncertainties (because of the unknown future evolution of some of the drivers). [Carolina Vera, Argentina]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51124	97	52	#REF!	53	Surpassing the 2 deg target applies to the regional temperature I assume? The 2 deg target is global and not intended to be interpreted regionally [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21192	98	17	98	17	Section 10.4.3.2.5: Please change “The signal-to-noise ratio given by….” by “The SNR given by….” [Gwenaelle GREMION, Canada]	Not applicable: this text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45094	98	34	98	43	Ozturk et al within the CORDEX Central Asia framework have published two papers about the Central and eastern Eurasia region. T. Ozturk, M. T. Turp, M. Turkes, and M. L. Kurnaz, "Projected Changes in Temperature and Precipitation Climatology of Central Asia CORDEX Region 8 by Using RegCM4.3.5", Atmospheric Research 183, 296-307 (2017). T. Ozturk, H. Altinsoy, M. Turkes and M. L. Kurnaz, "Simulation of Temperature and Precipitation Climatology for the Central Asia Cordex Domain by Using RegCM 4.0" Climate Research 52, 63-76 (2012). [Levent Kurnaz, Turkey]	Not applicable: this text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51126	99	4	#REF!	45	would be good to refer to Atlas.5.6.3.2 in this section, where an assessment of regional European projections is presented [Bart Van den Hurk, Netherlands]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
55742	99	4	99	18	It is important to mention that the temperature increases over Northern Fennoscandia have been relatively minor in recent decades possibly caused by a complex feedback between cloud cover and temperature that differs on different timescales. See: Young, G. H. F., Gagen, M. H., Loader, N. J., McCarroll, D., Grudd, H., Jalkanen, R., et al. (2019). Cloud cover feedback moderates Fennoscandian summer temperature changes over the past 1,000 years. Geophysical Research Letters, 46, 2811– 2819. https://doi.org/10.1029/2018GL081046 [Iain Robertson, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
54962	99	4			Euro-Mediterranean would be better to name the regions I guess [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
54964	99	4			please assess also Brogli et al. 2019 : Brogli, R., Kröner, N., Sørland, S. L., Lüthi, D., & Schär, C. (2019). The Role of Hadley Circulation and Lapse-Rate Changes for the Future European Summer Climate. Journal of Climate, 32(2), 385-404. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
54966	99	4			please also assess Somot et al. 2008 for the amplification of the Euro-Mediterranean summer warming and drying due to regional air-sea coupling in RCMs. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
54968	99	4			Please assess the role of decreasing aerosol load as a factor explaning the strong Euro-Mediterranean summer warming [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
30054	99	12	99	12	I wouldn't consider my 2018 paper to be an appropriate reference for this point. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
32560	99	16	99	16	Don't think the stratospheric vortex is relevant for summer. Suggest omitting it. [Isla Simpson, United States of America]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30056	99	17	99	17	I wouldn't consider my 2018 paper to be an appropriate reference for this point. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
21168	99	18	99	22	"local processes and feedbacks will affect future European summer temperatures" and "its impact on the mean summer temperatures in Central and Northern Europe is limited" These two sentences seem to contradict each other. [Gwenaelle GREMION, Canada]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
56676	99	24		34	assess Kroner et al. 2017 and Brogli et al. 2019 (for other explaning factors of the strong Southern Europe Summer warming. Brogli, R., Kröner, N., Sørland, S. L., Lüthi, D., & Schär, C. (2019). The Role of Hadley Circulation and Lapse-Rate Changes for the Future European Summer Climate. Journal of Climate, 32(2), 385-404. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
56678	99	24		34	also assess Sorland et al. 2018, Sørland, S. L., Schär, C., Lüthi, D., & Kjellström, E. (2018). Bias patterns and climate change signals in GCM-RCM model chains. Environmental Research Letters, 13(7), 074017. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
30240	99	38	99	38	Delete: ", submitted" [Ole B. Christensen, Denmark]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
56680	99	43		45	please add references concerning rôle of aerosols in future climate change over Europe [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
51128	100	7	100	29	this section could be merged with Atlas.5.6.3.2, or at least a strong cross-reference needs to be made [Bart Van den Hurk, Netherlands]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
56682	100	12			Be careful with this reference as only one RCMs in the ensemble used in Bartok et al. takes into account the future evolution of aerosol load in scenario (HMS-ALADIN). This probably creates inconsistency between the RCMs and the GCMs. Anote that ALADIN agrees with its driving GCM. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
56684	100	21		25	Two recently submitted papers may help to support the assessment here : Gutierrez et al. ERL, Boé et al. Clim Dyn if they are accepted in due time. [Samuel Somot, France]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
21170	100	28	100	29	Is only 99th quantile extreme SST expected to warm in Mediterranean? [Gwenaelle GREMION, Canada]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter
21172	100	28	100	29	What spatial scale is the annual mean? [Gwenaelle GREMION, Canada]	Not applicable: text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21174	100	37	100	55	In the near term (2021-2040), individual models (22 CMIP GCMS) do not show the consistent agreement, but in the latter term (2050-2099), 15 of 17 CMIP GCMS agreed on substantial increase in drought condition. This is somehow not in accordance with the intuition. Usually the prediction is more confirmed when it is closer to real time. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21194	100	40	100	40	Section 10.4.3.2.7: Please change "…AR5, (Seager et al., 2014) have examined near-term (2021–2040) changes..." by "…AR5, Seager et al. (2014) have examined near-term (2021–2040) changes..." [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21196	100	44	100	44	Section 10.4.3.2.7: Please change "(Seager et al., 2014) also found in..." by "Seager et al. (2014) also found in..." [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
32562	100	46	100	46	Arguments have been made for causes of the circulation changes e.g., Simpson et al 2015, doi: 10.1038/NCLIMATE2783. Perhaps this should be mentioned? [Isla Simpson, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21198	100	46	100	46	Section 10.4.3.2.7: Please change "(Ting et al., 2018) extended the analysis of..." by "Ting et al. (2018) extended the analysis of [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21200	100	49	100	49	Section 10.4.3.2.7: Please change "…(Cook et al., 2015a) used data from 17 CMIP5 GCMs and..." by "…Cook et al. (2015a) used data from 17 CMIP5 GCMs and..." [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
6239	100	53	100	53	Further understanding of ecosystem response is needed, eventhough frequently forest ecosystem has been reported [Mostafa Jafari, Iran]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21202	100	53	100	53	Section 10.4.3.2.7: Please change "…(Mankin et al., 2017) showed that feedbacks between..." by "…Mankin et al. (2017) showed that feedbacks between..." [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21176	101	4	101	5	Please provide the explanation or reference regarding northen parts have more uncertainity and southwest US has more consensus. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21178	101	23	101	23	It is unclear at which time there is low confidence in projecting future changes in precipitation. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21180	102	15	102	15	Please define"main Caribbean" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
43174	102	18	102	31	A couple of additional relevant references for your consideration: Franco-Fuentes et al. 2015 (https://doi.org/10.1007/s00382-014-2258-6), Jones et al. 2016 (http://dx.doi.org/10.1002/2015JD024342). [Melissa Bukovsky, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51130	102	46	21	47	this is a peculiar confidence statement: medium confidence of something due to low confidence of something else. I would replace the "due to" by "and" [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21344	102	54	103	3	The sentence written in this way is very generalised and could be misleading and as such it relativizes the problem of UHI. The statement concerns only one parameter, i.e. evaporation. Namely, according to Oleson (2012) changes in evaporation that warm the rural surface more than the urban. It should be noted, and cited properly that "these results provide evidence that urban and rural areas respond differently to climate change". [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
43454	102		104		This section is titled "10.4.3.2.9 Asian cities" but only really refers to Hanoi and Tokyo; it is suggested this section address more asian megacities, or be renamed. [Saad Amer, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21346	103	5	103	8	confusing since: 1. Chapter is on Asian cities; it is hard to compare Asian and EU cities in this matter. Thus, if the purpose is comparison, it should be written more concise with clear aim 2. sentence is too long [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21350	103	5	103	17	I suggest that entire paragraph, rows 5-17, is re-written, pointing to the differences and conclusions; and not only retelling parts of the researches conducted, without clear aim. [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
43452	103	5	103	17	This paragraph does not refer to asian cities; the paragraph prior is further a generalization and not specific to asian cities despite the section title 50 10.4.3.2.9 Asian cities [Saad Amer, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21204	103	7	103	7	Section 10.4.3.2.9: Please change "…Hamdi et al., 2014; Kusaka et al., 2012; KUSAKA et al., 2012; McCarthy et al., 2012)" by "…Hamdi et al., 2014; Kusaka et al., 2012; McCarthy et al., 2012)" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21348	103	9	103	11	Sentence is unclear, to general [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51132	103	54	28	54	typo in sentence ("i") [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21206	103	54	103	54	Section 10.4.3.2.9: Please change "… expansion of Tokyo in the past 30 years will continue as it i (Adachi et al., 2012b)" by "…expansion of Tokyo in the past 30 years will continue as it (Adachi et al., 2012b)" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21352	103	54	103	55	unclear the aim of the sentence, especially if the reader is not familiar with the scenario(s) [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51134	104	2	37	2	typo "s" [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
51136	104	8	37	9	does this mature city state also apply to Brussels (that had similar findings)? [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21208	104	27	104	27	Section 10.4.3.2.9: Please change "…over the greater Hanoi ((Doan and Kusaka, 2016) and Doan et al. (2019))." by "…over the greater Hanoi (Doan and Kusaka, 2016; and Doan et al., 2019)" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.
21356	105	8		45	Please refer also to Krishnan et al., 2019 Krishnan R. et al. (2019) Unravelling Climate Change in the Hindu Kush Himalaya: Rapid Warming in the Mountains and Increasing Extremes. In: Wester P., Mishra A., Mukherji A., Shrestha A. (eds) The Hindu Kush Himalaya Assessment. Springer, Cham [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32564	105	14	105	15	What's "temperature rate"? Should it be "rate of temperature rise"? [Isla Simpson, United States of America]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.
26224	105	30	105	30	Following text may be added here. A high resolution AGCM projects a contrasting water budget in the future Tibetan Plateau between the west and the east where surface temperature increases are higher, an increasing rate of precipitation is greater, soil moisture becomes wetter, and runoff increases more over the western Tibetan Plateau than over the eastern Tibetan Plateau (Kitoh and Arakawa, 2016). Kitoh, A., and Arakawa, O. (2016). Reduction in the east-west contrast in water budget over the Tibetan Plateau under a future climate. Hydrol. Res. Lett., 10, 113-118. doi:10.3178/hrl.10.113. [Akio Kitoh, Japan]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.
21210	105	32	105	32	Section 10.4.3.2.10: Please change "…the near future (2020–2049) for the western/easternHimalaya, a scenario…" by "…the near future (2020–2049) for the western/eastern Himalaya, a scenario…" [Gwenaelle GREMION, Canada]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.
51138	105	47	105	49	this section seems to show considerable overlap with the previous paragraph [Bart Van den Hurk, Netherlands]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.
30132	106	12			In order to reduce such biases and to provide more robust climate change information in the Himalayan region, Jury et al. (Int. J. Climatol., in review) have exemplified a climate change study that (1) sorts out GCMs from the CMIP5 ensemble and RCMs from SA- and EA-CORDEX that fail to reproduce important processes such as elevation dependent warming, the Indian Summer Monsoon, and Western Disturbances and (2) applies a climate change preserving bias adjustment method for temperature and precipitation. As a result they found a robust increase of temperatures that is amplified by the elevation dependent warming, an increase (decrease) in precipitation associated with the Indian Summer Monsoon (Western Disturbances), and a strong descrease in snow accumulation, especially during May and September where large parts of former solid precipitation are projected to precipitate in liquid form in the future. Jury, M., Mendlik, T., Tani, S., Truhetz, H., Maraun, D., Immerzeel, W. W., Lutz, A. (in review). Climate projections for glacier change modelling over the Himalayas. Int. J. Climatol. [Heimo Truhetz, Austria]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the Himalayas box of the SOD revision to Chapter 10.
51140	106	35	46	35	it is confusing to associate a typology scale ("urban") with a resolution scale ("high"). I can imagine that low resolution (e.g. single column models) could also be used to make assessments applicable to urban environments [Bart Van den Hurk, Netherlands]	Not applicable. Text has been removed.
21218	106	37	106	38	It could be helpful to give an explanation/definition of climate services here - possibly following the EU roadmap, GFCS etc.? This could give a clearer starting point to the reader to understand in which manner climate services in addressed. [Gwenaelle GREMION, Canada]	Not applicable. Text has been removed. Climate services is now discussed in section 10.5.1.3

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
56072	106	41	116	28	I have mix feelings about this section. In my view the message conveyed is not clear and clean enough to deserve the 10 pages devoted to it. I would suggest to make the content of the section more concise and move it in a introductory subsection of 10.6. I find 10.6 very effective, clear and useful. [Corti Susanna, Italy]	Rejected : Section 5 helps lay the foundation for the discussion in Section 10.6. More important, Section 5 gives important information for determining when,, where and how messages of climate change can be effective. In addition, Section 5 has been partly restructured in conjunction with the Atlas.
51142	107	21	46	21	what is ASK? [Bart Van den Hurk, Netherlands]	Accepted: ASK stands for Allen-Stott- Kettleborough. References added to the text
48328	107	22	107	22	Suggest giving a bit more detail here and adding "an attribution analysis of" before "model experiments". [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted
51144	107	25	46	26	not sure I understand what is implied with the phrase about "knowledge as information" [Bart Van den Hurk, Netherlands]	Accepted : The first part of the paragraph has been rewritten.
48330	107	25	107	32	This is framing material and would be more relevant at the start of 10.5 (or possibly earlier, e.g. in 10.1). Also, the first sentence is confusing and should be rephrased. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted : The first part of the paragraph has been rewritten.
51146	107	28	53	32	I like this analysis of the relation between data, knowledge and information. But I wonder whether there is some trend, some development in insights or demands that give this analysis a bit more a dynamic context. Do we realize the implications of this relationship better now climate services are becoming more familiarized and applied? Is there a fundamental new insight since AR5? [Bart Van den Hurk, Netherlands]	Noted : The next two paragraphs give the historical context and the recent developments.
48332	107	31	107	32	Suggest extending the end of the sentence thus: "... coproduction with users to incorporate their knowledge to define the context." [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been modified.
39656	107	34	107	38	There is literature discussing the limitations of the "linear supply chain" approach in providing socially valuable climate information that could be assessed here. Meinke H, Nelson R, Kokic P, Stone R, Selvaraju R & Baethgen W(2006) Actionable climate knowledge: From analysis to synthesis. Climate Research 33, https://doi.org/10.3354/cr033101. Lemos et al. (2012), Haines S (2019) Managing expectations: articulating expertise in climate services for agriculture in Belize. Climatic Change. https://doi.org/10.1007/s10584-018-2357-1 [Carolina Vera, Argentina]	Accepted, assuming that Lemos et al. (2012) is this paper : DOI: 10.1038/NCLIMATE1614
51148	107	37	53	37	I would say, also providers have assumptions that are not always true, such as the usefulness of their approaches for users [Bart Van den Hurk, Netherlands]	Accepted : The last part of the sentence was modified. "possible misunderstandings of user needs and provider capabilities in the hand over from"
14558	107	40	107	47	Bottom-up approaches, sometimes also referred to as "scenario-neutral" impact studies (cf. Prudhuomme et al. 2010, doi:10.1016/j.jhydrol.2010.06.043), have recently gained popularity. These include some studies using multimodel-based probabilitistic projections of regional climate change to quantify the of exceeding critical impact thresholds (Pirttioja et al. 2019, doi:10.1016/j.agrformet.2018.10.006). This is an additional aspect of how regional climate projections can be used that is worth mentioning here. [Stefan Fronzek, Finland]	Accepted, and additional aspect noted in text

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48334	107	47	107	47	Suggest adding the following reference: Jack et al., 2019, Climate Risk Narratives: An iterative reflective co-production process for producing and integrating climate knowledge (Climatic Change, submitted) available from Chris Jack <cjack@csag.uct.ac.za>. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable. Text has been removed
39658	107	49	107	54	It is not clear which are the references supporting the discussion included in this paragraph [Carolina Vera, Argentina]	Accepted, accommodated in the revision in response to other comments on the text following.
51150	107	51	4	52	This type of information examples to illustrate climate services for the agricultural sector does not really apply to farmers. Farmers are interested in growing season onsets etc, but typically not at climate time scales but at seasonal time scales. They are usually very adaptive at a few years time scale. Maybe crop cultivar specialists, or national strategic food security planners need this information for making assessments of the type of agriculture that may be realized in a further future, with implications for regional planning, financial structures, legislation etc. See e.g. vdHurk et al 2016 (doi:10.1016/j.cliser.2016.01.001.) for a discussion on user needs in the climate services domain [Bart Van den Hurk, Netherlands]	Taken into account. Text revised with implications for farming practices considered.
51152	107	54	23	54	I would be curious to know whether there are really farmers that can be considered end users for this kind of information. Maybe my previous statement is wrong. In that case it would be good to provide a literature reference about who the end users of this information are [Bart Van den Hurk, Netherlands]	Taken into account. Text adapted to note this is not at the time scale of existing farming practices, and link this type of information to long term assessment of climate change information for agricultural practices
51154	108	9	46	9	should a comma be added after "research"? [Bart Van den Hurk, Netherlands]	Not applicable. Text has been modified.
51156	108	12	46	12	Althought this statement on S2S is very true it seems a bit out of context, or at least isolated here [Bart Van den Hurk, Netherlands]	Accepted : Sentence deleted as being out of context.
51158	108	14	54	34	This is a very useful paragraph. But in an IPCC report on climate CHANGE a discussion of communication on climate that is mainly to be interpreted as (seasonal) climate FORECASTS deserves some explicit justification or disentanglement of different scopes of climate information [Bart Van den Hurk, Netherlands]	Accepted : text revised accordingly in conjunction with text changes in response to other comments on this section, and the revision speaks to the relationship between forecast time scales and the climate change time scale for policy and planning.
21182	108	22	108	22	what is the full name of CLIMANDES? [Gwenaelle GREMION, Canada]	Taken into account: Not included in the SOD
21186	108	25	108	25	Section 10.5.1: "…might be ill equipped to integrate…" I don't think that the word "ill"is appropriate in this context [Gwenaelle GREMION, Canada]	Not applicable. Text has been removed
39662	108	29	108	34	Another reference is Bremer S, Stiller-Reeve M, Blanchard A, Mamnun N, Naznin Z and Kaiser M (2018) Co-producing 'post-normal' climate knowledge with communities in northeast Bangladesh. Weather Climate and Society. https://doi.org/10.1175/WCAS-D-17-0033.1 [Carolina Vera, Argentina]	Taken into account: Not included after further text revisions that were also subject to length constraints.
29624	108	46	108	46	Relevant reference to be cited here: https://www.sciencedirect.com/science/article/pii/S2405880717300055 [Rodrigo Manzanas, Spain]	Accepted, reference has been added
51160	108	50	109	7	I would add a statement that addresses the need to explore where, when and how user interaction is most effective. Over-engagement, false expectations, unnecessary involvement in particular steps of the service development etc. may lead to very sub-optimal interaction arrangements [Bart Van den Hurk, Netherlands]	Accepted. These points considered in the text revisions.
48336	109	2	109	2	Suggest replacing "information" with "knowledge". [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21220	109	6	109	8	Possibly add a sentence on the role of climate services on regional scales, and why they are specifically important to address regional climate change problems. [Gwenaelle GREMION, Canada]	Taken into account: The SOD includes a subsection (10.5.1.3) that, in part, is specifically devoted to climate services and their role in addressing regional climate-change problems.
51162	109	13	5	13	context about the climate information? Or about the information need? [Bart Van den Hurk, Netherlands]	Accepted : Rewritten to make the context clear that without a societal context for the message, the information need is not easily met.
21222	109	14	109	15	This importance of putting the climate information into the decision-making context is also stressed by Langendijk et al. 2019, please consider to include this reference as well. https://doi.org/10.3389/fenvs.2019.00006 (Three Ways Forward to Improve Regional Information for Extreme Events: An Early Career Perspective: Langendijk, G.S., Aubry-Wake, C., Osman, M., Gulizia, C., Attig-Bahar, F., Behrens, E., Bertoncini, A., Hart, N., Indasi, V.S., Innocenti, S., van der Linden, E.C., Mamnun, N., Rasouli, K., Reed, K.A., Ridder, N., Rivera, J., Ruscica, R., Ukazu, B.U., Walawender, J.P., Walker, D.P., Woodhams, B.J. and Yılmaz, Y.A., 2019. Frontiers in Environmental Science. 7:6.) [Gwenaelle GREMION, Canada]	Taken into account: The publication was considered, but it did not fit well with the issue compared to other references.
51164	109	18	5	19	Interesting statement but the sentence is not complete. What is implied with this sub-sentence? [Bart Van den Hurk, Netherlands]	Accepted : Sentence modified to follow from the previous sentence.
21378	109	26	109	37	specifically line: 37, please consider to include more specifically the timing of the delivered/co-produced information is of importance while considering the context (as for instance politics/governements are highligh dynamic, e.g. elections etc.). this is also adressed in Langendijk et al. 2019: https://doi.org/10.3389/fenvs.2019.00006 [Gwenaelle GREMION, Canada]	Accepted. Point changed to recognize the importance of timing.
51166	109	33	5	34	Atlas.6.2 discusses a couple of communication principles that show overlap with these context examples. Principle 8 for instance explicitly refers to stakeholder values [Bart Van den Hurk, Netherlands]	Accepted : Section 5 and the Atlas have had discussions about overlapping material. Restructuring both around issues of climate communication has occurred, and each will point to relevant text in the other.
48338	109	35	109	36	Suggest adding a reference to the Otto et al. paper on the Sao Paulo drought here. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted, reference has been added.
51168	109	44	7	48	It is unclear whether this is a set of statements on frames that may not be true (such as the framing on engineers always seeking quantitative information). Of course I do like figure 10.26 (I participated in creating it) I am not sure it is a proper illustration of what is implied here. It would better fit in the Atlas.6.1.3 subsetction on storylines [Bart Van den Hurk, Netherlands]	Accepted: accommodated in the revision of the storylines material in sec 5 and 6 and in relation to a new figure on storylines.
51170	110	5	24	5	see comment on p108 line 33 on the Atlas.6.2. text on values [Bart Van den Hurk, Netherlands]	Noted and accommodated as feasible in the text revisions.
48340	110	5	110	5	Suggest adding "ethics" before "values" and "actors and" before "communities" and then including specific material on ethics in this section. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account: There is an important distinction between ethics and values, and the focus here is on values. The point on "actors" is accepted
51172	110	10	49	10	I'm not sure it is necessary to correspond to values of all parties. In many political processes different values are present and yet a single decision is taken. [Bart Van den Hurk, Netherlands]	Rejected : A single decision may be taken, but it is not necessarily effective. The papers cited here provide evidence that the values of all parties must be taken into account for the messaging to be effective

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51174	110	16	53	16	here a notion that people have different values (not only different background) would be appropriate [Bart Van den Hurk, Netherlands]	Accepted : Sentence slightly revised to refer to targeting people with a variety of backgrounds, which could give them differing value systems.
51178	110	32	49	41	Nice section. Relates to the principle nr 7 (on post-truth society) in Atlas.6.2 [Bart Van den Hurk, Netherlands]	Noted with thanks
48342	110	32	110	32	Suggest replacing "receptiveness" with "receptivity" (and add a reference if those in the sentence are not sufficient). [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted Changed "receptiveness" to "receptivity".
21358	110	32	110	52	for paragraph 32-41, 43-52; please refer also to Shalev, 2015 and references therein Shalev, I., 2015: The climate change problem: promoting motivation for change when the map is not the territory. Front Psychol. 6: 131. [Gwenaelle GREMION, Canada]	Accepted. Reference added.
41398	110	32	111	18	Very useful paragraphs on climate communications. Are there more examples from different parts of the world? [Debra Roberts, South Africa]	Noted : The examples are meant to illustrate concepts concisely and not provide global, region-by-region examples.
51176	110	37	53	37	insert "set of" before "values" [Bart Van den Hurk, Netherlands]	Rejected : Meaning of sentence not changed by added words.
39660	110	43	110	51	Another useful reference could be: Hernández, Moron, Fossa Riglos, Muzi (2015) Confronting farmer's perceptions of climatic vulnerability with observed relationship between yields and climate variability in Central Argentina. Weather, Climate and Society, Vol. 7, No. 1. pp 39-59. https://doi.org/10.1175/WCAS-D-13-00062.1 [Carolina Vera, Argentina]	Noted: Not included in SOD due to length limitations and because this is an assessment of the topic, not a review of all relevant literature.
43456	110	47	110	48	Recommend using the term 'confirmation bias' here. Poortinga, Wouter & Spence, Alexa & Whitmarsh, Lorraine & Capstick, Stuart & F. Pidgeon, Nick. (2011). Uncertain Climate: An Investigation into Public Scepticism about Anthropogenic Climate Change. Global Environmental Change-human and Policy Dimensions - GLOBAL ENVIRON CHANGE. 21. 1015-1024. 10.1016/j.gloenvcha.2011.03.001. [Saad Amer, United States of America]	Rejected: Confirmation bias does not appear to be discussed in the paper, and the paper does not appear to give further evidence supporting the contentions of Kahan (2012).
51180	110	49	23	49	I don't understand the notion on "capacity for reflection" [Bart Van den Hurk, Netherlands]	Accepted ; reworded - « and, notably, with increased ability to think carefully about the messages »
43458	110		110		It could be added that perception of consensus on climate change further impacts people's perceptions of climate change. Goldberg, M. H., van der Linden, S., Leiserowitz, A., & Maibach, E. (2019). Perceived Social Consensus Can Reduce Ideological Biases on Climate Change. Environment and Behavior. https://doi.org/10.1177/0013916519853302 [Saad Amer, United States of America]	Not applicable / Taken into account. This figure has been replaced for the SOD. The paper Goldberg et al. Has been referenced in Section 5.
39664	111	23	111	41	A useful reference for this discussion could be Moron et al. (2016, https://doi.org/10.1016/j.crm.2015.03.001) that concluded about the role of various intra-seasonal characteristics of the rainy seaons, in both actual yields and people's representations [Carolina Vera, Argentina]	Noted: Not included in SOD due to length limitations and because this is an assessment of the topic, not a review of the literature.
51182	111	31	23	32	Reference to Atlas.6.1.3 (storylines) would be appropriate [Bart Van den Hurk, Netherlands]	Not applicable. This particular comment is not applicable for the SOD since Atlas and Ch10 since then has coordinated the two sections.
51184	111	40	15	41	this is a very generic statement, that does not give any concrete picture of what this implies [Bart Van den Hurk, Netherlands]	Rejected : The statement is a summary of the paragraph. Slightly reworded to make this clear.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21212	111	46	11	48	Section 10.5.2.4: Please change “Users often require and need information from compound events (e.g. concurrent drought and heat (Zscheischler and Seneviratne, 2017); concurrent precipitation and wind extremes (Martius et al., 2016))and in the form of non-traditional variables” by “Users often require and need information from compound events [e.g. concurrent drought and heat (Zscheischler and Seneviratne, 2017); concurrent precipitation and wind extremes (Martius et al., 2016)] and in the form of non-traditional variables” [Gwenaelle GREMION, Canada]	Editorial- copyedit to be completed prior to publication
51188	111	46	46	47	I would remove the examples between brackets and merge these with the set of examples at the end of this paragraph [Bart Van den Hurk, Netherlands]	Rejected : These examples help clarify what is meant by compound events.
51186	111	48	18	48	I would replace "variables" by "metrics", who are "non-traditional" by their joint sampling and conditional dependency [Bart Van den Hurk, Netherlands]	Accepted. 'Variables" changed by "metrics".
51190	112	5	53	5	"variables" -> "metrics". And the statement that they can be "directly" computed from climate model output depends on what "directly" means; often quite elaborate changes in searching the climate archive are needed to make joint or conditional sampling possible [Bart Van den Hurk, Netherlands]	Taken into account: Not all non-traditional variables are referred to as metrics. However, we have revised the text to define our meaning of non-traditional variables and to state that many can be directly computed.
48344	112	8	112	8	Suggest adding a definition of the heat index to provide context to the 40.6. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. The index unit is degrees Celsius
42616	112	23	112	26	I think it is worth adding this reference: L. Dekens, S. Parey, M. Grandjacques, D. Dacunha-Castelle Multivariate distribution correction of climate model outputs: a generalization of quantile mapping approaches Environmetrics, 28 (2017), 10.1002/env.2454 I think It might also be important to mention that the issue of multi-variate bias adjustment is not relevant only in the context of compound events, but also for many downstream modellling applications such as for agriculture and hydrology. An example might be: Galmarini et al. Adjusting climate model bias for agricultural impact assessment: How to cut the mustard, Climate Services, 2019, https://doi.org/10.1016/j.cliser.2019.01.004 [Paula LM Gonzalez, United Kingdom (of Great Britain and Northern Ireland)]	Not applicable: the text on bias-adjustment has been removed. Bias adjustment is described in Section 10.3 and the C-C Box.
40898	112	29	112	35	Revise to better link storylines and pathways, as in: "It is often difficult and not useful to assign likelihood to events that are very complex or rare. In such cases, storylines (Section 10.5.3) can be used to explore potentially devastating events. Well informed storylines are particularly helpful to study compound and cascading events, which can often not be addressed by standard probabilistic frameworks. Storylines are developed by presenting physically self-consistent unfolding of past events and may include consequent plausible future events or pathways. Storylines and pathways frame risk for human systems and ecosystems in an event-oriented rather than a probabilistic manner, while providing a physical basis to partition uncertainty and explore the boundaries of plausibility (Shepherd et al., 2018)." [Liese Coulter, Canada]	Rejected : The original wording is more concise and covers the keys points, which are further elucidated in 10.5.3.
51192	112	37	5	39	I would make this statement a bit more focused on the need to involve users to define relevant compound events [Bart Van den Hurk, Netherlands]	Accepted : Text revised to make a more general statement and moved to end of 10.5.2.2.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
39024	112	42			Nice and comprehensive review of narratives and storylines. Inclusion of illustrative material would greatly enhance the readability. Unfortunately placed near the end of Chap 10. Isn't is possible to transfer the discussion here, at leat the part which is of universal character, to the earlier part of the report? [Masahide Kimoto, Japan]	Accepted: addressed as part of a wider reworking of the material between here and elsewhere in the chapter.
30058	112	46	114	14	The criticism I always get of storylines is that they don't provide probabilities. (This is similar to the argument that event-based attribution does not provide changes in frequencies.) But if the uncertainty is epistemic, or systematic (what is here called model uncertainty), then there is no accepted basis for providing probabilities; one model, one vote is widely accepted as inadequate, and there is as yet no accepted alternative. So the lack of probabilities is not a disadvantage at all, in fact it might be seen as a good thing because it makes the epistemic uncertainty transparent. These issues are discussed in Shepherd (2019 PRSA doi: 10.1098/rspa.2019.0013). [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Noted : We do talk in the section about the complementary relationship between storylines/narratives and probabilistic projections.
48346	112	47	112	47	Suggest adding the following reference: Jack et al., 2019, Climate Risk Narratives: An iterative reflective co-production process for producing and integrating climate knowledge (Climatic Change, submitted) available from Chris Jack <cjack@csag.uct.ac.za>. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Noted: Not included in SOD due to length limitations and other reworking of the text.
51194	112	51	5	51	Not only circulation change, also other physical processes can be subject of storylines (see e.g. the Hazeleger et al 2015 paper) [Bart Van den Hurk, Netherlands]	Accepted. Text changed and reference included
9348	113	3	113	9	I do not understand.. Taking the risk to be the product of probability times the impact, then surely low probability events may pose a substantial risk, which is exactly what you claim. Now I can understand that narratives/storylines will give more insight, and the points made by Shepherd seem well taken. However, as long as we accept market economy, end users of the concept of risk will be either insurance companies or customers of insurance companies, and what they will need are numerical figures about risk so as to compute the cost of insurance. Therefore, it seems to me that probability approaches answer a major need. [philippe waldteufel, France]	Accepted: The sentence conveys an ambiguous message and requires greater clarity. The narratives material in the chapter reworked in response to other comments, this and the complementarity with probability approaches addressed in the revised text.
51196	113	11	5	11	add "high impact" after "low probability" [Bart Van den Hurk, Netherlands]	Accepted: "high-impact" added
51198	113	13	7	19	The IPCC glossary now links storylines to the description of global societal trends supporting the (emission) scenarios. It is necessary to adjust this glossary and mae the definition or application scope of storylines wider than this [Bart Van den Hurk, Netherlands]	Taken into account : There has been substantial discussion occurring about what the document is to say about storylines.
21214	113	16	113	16	Section 10.5.3.1: Please change “…whereas Fløttum & Gjerstad (2017) speak of the narrative...” by “…whereas Fløttum and Gjerstad (2017) speak of the narrative...” [Gwenaelle GREMION, Canada]	Editorial- copyedit to be completed prior to publication

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
40900	113	21	113	25	The advantage of well-timed storyline messages to support application of new knowledge is not explicit. At end of line 25 add: "Storylines can support future thinking in decision-making when messages are timed to support the application of new knowledge in decision-cycles. Coulter et al. (2019) provided examples where climate narratives were not applied to inform decisions during the simulation and prediction phases of prospection (Szpunar et al. 2014) so that future climate knowledge did not inform intention setting and planning for adaptation." REFERENCES (Coulter, L., Serrao-Neumann, S., and Coiacetto, E. (2019). Climate Change Adaptation Narratives: Linking climate knowledge and future thinking. Futures 111, 57-70) (Szpunar, K.K., Spreng, R.N., and Schacter, D.L. (2014). A taxonomy of prospection: introducing an organizational framework for future-oriented cognition. Proc Natl Acad Sci U S A 111, 18414-18421.) [Liese Coulter, Canada]	Taken into account: The material on storylines and narratives substantially reworked in response to this and other comments. This important point on the timing taken into account in the construction of a new figure on storylines and narratives.
51200	113	34	7	34	Expert opinion on what? Societal impact? Physical processes leading to this impact? Which expert is intended here? [Bart Van den Hurk, Netherlands]	Accepted: the points made integrated into the text as much as feasible
39666	113	44	113	44	check consistency and minimize overlapping witht the discussion included in Chapter 1 section 1.2.4.3 [Carolina Vera, Argentina]	Accepted: addressed in revisions of the narratives text
51202	113	53	114	1	Here the reference to the KNMI'14 scenarios could be inserted, as these are build on a storyline of (uncertain) response of regional atmospheric circulation to greenhouse gas emissions [Bart Van den Hurk, Netherlands]	Rejected : While the KNMI'14 scenarios might be useful, the report describing them does not appear to be peer-reviewed, and there is already sufficient peer-reviewed literature supporting this paragraph.
51204	114	16	54	18	also it could be considered to adjust this storyline section with Atlas.6.1.3, or merge the two pieces of text [Bart Van den Hurk, Netherlands]	Accepted : There has been substantial discussion between Chapter 10 and the Atlas about exchanging text between the two and ensuring that unnecessary redundancy does not occur.
9346	114	42	114	47	I find this paragraph particularly vague. Some ensembles make use of different initial conditions, and this may reflect measurement uncertainties as well as internal variability. Other ensembles make use of models with different structures and/or parameters. This is a complicated issue and dealing with it requires accurate language. Anyway, the concluding sentence in the paragraph does not help much. [philippe waldteufel, France]	Noted These details and additional, related details are now covered in 10-106, line 43 - 10-107, line 19.
51206	114	45	54	46	There are many examples where different observational datasets are used as a reference [Bart Van den Hurk, Netherlands]	Accepted: the points made integrated into the text as much as feasible
41400	114	54			How does one communicate deep uncertainty? viz possibilities outside the prediction space. [Debra Roberts, South Africa]	Noted : The point here is about the issue of assuming a complete possibility space, rather than how to communicate deep uncertainty. The point is important, and taken into consideration in other parts of the chapter.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
9340	115	4	116	21	I have doubts about several paragraphs in this part of chapter 10. Lines 4 to 12: the idea seems that throwing in additional information (such as constraints, or rather a priori probabilities) will reduce the output uncertainties. Everybody knows about this, even if you prefer to formulate it in a way which is not habitual. . I do not understand the expression "our projected range" on line 8, though. Lines 14 to 44: I am ready to believe that producing information message is a well defined job with specific abilities in the field of communication. As indicated on line 14, the job of climate scientists is to understand, and to produce climate information. As far as I can say, this distinction is clearly made in the article by Moss (2016) you refer to. Of course, climate scientists and message producers should talk together. However you apparently suggest that the message producer take over the whole lot and I do not understand why. [philippe waldteufel, France]	Taken into account: We do not intend to communicate that "that the message producer take over the whole lot" … the text recrafted in light of this.
9342	115	4	116	21	Lines 46 to 50: concerning the first sentence, the so called assumption is far from pure speculation: that the ensemble mean is more skilful thant most existing single models is indeed established (Rougier, 2016), and one should keep in mind also the considerable evidence supplied in this respect by numerical weather prediction. Of course every existing model suffers errors. An error free model would always do better than ensemble, but it is not available. Concerning the next sentence, I would not call the mapping out of percentiles an assumption: it is a technique, and as shown by the Atlas associated to the report it is not the only one. Lines 16 to 21: certainly the best way to take advantage of multipe lines of evidence is to rely on the brains and abilities of an expert or a group of experts. However I do not see why it would be necessary to introduce subjectivity. [philippe waldteufel, France]	Accepted: addressed in the word crafting revisions in relation to the prior comment 9340.
39698	115	6	115	12	Avoid the use of term "risk" when its use is not consistent with the definition provided in section 1.2.4.1 of Chapter 1 [Carolina Vera, Argentina]	Accepted
51208	115	10	27	12	Also many examples exist where our progress in understanding the complexity of the climate system actually increases the nr of degrees of freedom that the climate system govern, thereby enhancing the nr of possible futures and thus increasing future uncertainty (e.g. recent evidence on Antarctic instability that increases the plume width of SLR scenarios) [Bart Van den Hurk, Netherlands]	Accepted: the points made integrated into the text as much as feasible
51210	115	19	8	23	also here the KNMI'14 figure could be inserted, as it is essentially a destillation of 245 CMIP5 projections into 4 discrete scenarios, designed to facilitate rapid exploration of climate change impacts by a wide community of users [Bart Van den Hurk, Netherlands]	Rejected. While an interesting figure, it is not a strong support for the discussion about assumptions.
21216	115	22	115	22	Section 10.5.4: Please change “…of impact models (e.g. (McSweeney et al., 2015)), the impact...” by “…of impact models (e.g. McSweeney et al., 2015), the impact...” [Gwenaelle GREMION, Canada]	Editorial- copyedit to be completed prior to publication
51212	115	52	116	10	Distillation is also a form of uncertainty reduction, and could be listed here as well [Bart Van den Hurk, Netherlands]	Accepted: and accommodated in the text
48348	116	6	116	10	Suggest adding, in reference to the McSweeney paper something along the lines of "or that models which do not represent an important driver of regional climate when simulating the current climate will not be able to simulation the implications of gloal climate change for the regional climate in question." So the last sentence could include two clauses and be written "based on the assumption that: (a) models that are ... ensemble; or, (b) " and then include something like the suggested text above. [Richard Jones, United Kingdom (of Great Britain and Northern Ireland)]	Accepted: the points made integrated into the text as much as feasible

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48064	116	31	116	31	For the three case studies (regions) of Section 10.6, there is a brief analysis of observational uncertainty. However, an extended analysis including all AR6 reference regions is missed (the most general assessment of observational uncertainty is provided in Atlas.3.1.1). Coordination between Chapter 10 and Chapter Atlas is required on this matter. [WGI TSU, France]	Rejected. It was decided at LAM2 that Chapter 10 would not make any analysis that cover all AR6 regions.
9526	116		132		This subsection would be enriched if another example, showing bottom-up examples, are addressed. Since this approach is gaining popularity among decision makers it would be very valuable if one study case is discussed. See for example: for water resources management and planning" (Hassanzadeh et al., 2016, Kalra et al., 2015, Moody and Brown, 2012, Grijsen and Patel, 2014, Ghile et al., 2014, Ray et al.,2018). Similarly for sea level rise: (Kwadijk et al., 2010). [Paltan Homero, United Kingdom (of Great Britain and Northern Ireland)]	Rejected : The three case studies in Section 6 were chosen as representative examples of the issues encountered with constructing climate messages, as stated in 10.6.1. The relative importance of climate change in relation to non-climate stressors, important for bottom-up approaches like stress testing,, is discussed already in Section 5.
21224	117	11	117	11	"50 l/person/day" is difficult to read, since the manuscript font makes it appear similar to 501. Perhaps spell out 50 litres. [Gwenaelle GREMION, Canada]	Accepted. Corrected as suggested
21342	117	11	121	11	page 10-117, line 11: Add the reference after following sentences: 50l/day…. Page 10-119, line 5: what about relationship between temperature and ENSO (if ENSO and rainfall has no relationship, did you check between ENSO and temperature??? page 10-122, line 10: what means "emergent-constraint techniques" for monsoon (please, paraphrase these sentences), page 10-122, please replace the word chiefly to the "major" , page 10-123, line 30: what kind of method is Shepherd's method, or do you mean that non scientific based approach? [Gwenaelle GREMION, Canada]	Accepted (partly - there are several individual comments, covering more than one subsection, combined into one). (a) P117, L11 - Accepted. Corrected as suggested. (b) P119, L5 - Rejected. ENSO-temp relationship has not been unpacked as it is tangential to the main problem described here, which is a rainfall deficit-driven drought. (c) P122 L10 (apparently L20) - Accepted. A very brief explanation of emergent constraint techniques is give, with link to a fuller reference to their introduction earlier in the chapter, and in a global sense to earlier chapters of the report." (d) P122 L?? Line referenced not given - Taken into account. The phrasing of this sentence has been revised. (e) P123 L30 - Noted. Sheperd's method is scientific; the authors do not understand what is meant by a non scientific-based approach. Please also see the response to CID 51232 and CID 21290.
21226	117	16	117	16	CoCT, 2018 presents the total GDP and GDP per capita in rands. Does the $ symbol refer to USD? Should rands values be included to account for fluctuating exchange rates? [Gwenaelle GREMION, Canada]	Accepted. Symbol corrected as suggested. Yes, exchange rates fluctuate widely, but the point of these figures is to show an order of magnitude rather than exact values. And USD is definitely easier to relate to than ZAR. There is little value in adding ZAR in this context.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51214	117	18	8	20	Apart from anthropogenic climate change, should we not also acknowledge natural variability that generated a sequence of dry years? [Bart Van den Hurk, Netherlands]	Noted. In the context of this statement, climate variability, even at longer time scales is generally expected to be dealt with within the established water resource management paradigms. If climate variability were a problem – then the paradigms would be at fault, not the variability itself. Change in variability might be a factor here, but that would generally be an effect of climate change.
21228	117	23	117	23	The 300 year event estimate includes 90% confidence intervals of 105-1280 year (Wolski, 2018). Are there paleodata that could provide further evidence of the rareness of this event? [Gwenaelle GREMION, Canada]	Noted. Not to our knowledge.
21230	117	26	117	26	The 22% statistic is found in the Frame and Killick reference, but the 14% is difficult to find (DWA, 2013 seems to state 15.3%). Has there been an update since 2013? Should the time frame for this reduction be included as well? [Gwenaelle GREMION, Canada]	Taken into account. There are newer data but from sources that are not really citeable – e.g. power-point presentations of municipality officials. Corrected to include value from DWA 2013.
21232	117	49	117	50	Reference should be Pienaar and Boonzaaier, 2018 [Gwenaelle GREMION, Canada]	Accepted. Corrected.
21234	117		135		Paleoclimate perspective is severely lacking for the case studies of section 10.6. [Gwenaelle GREMION, Canada]	Taken into account. The reviewer does not give any specific points to cover from paleoclimate analyses. Chapter 10 has been supplied a number of papers from PMIP4 analyses, which we have used as appropriate. The amount of paleoclimate analyses for the regions in section 6 are uneven in what is available to each and in what is relevant to the topic covered in each. Section 10.6.3, in particular will be able to include briefly some paleoclimate analysis.
21236	118	17	118	19	Reference Figure 10.28 here. [Gwenaelle GREMION, Canada]	Accepted.
21238	118	20	118	20	After mentioning that the anomaly was strongest in the mountains, it might be beneficial to note again that the mountains are where the catchment reservoirs are located for Cape Town. [Gwenaelle GREMION, Canada]	Accepted. Sentence amended
21240	118	25	119	6	The 10.6.2.3 section presents the natural and anthropogenic drivers of rainfall in South Africa. The studies cited here tend to focus on different seasons. It may be worthwhile to separate this section into the summer and winter seasons to better understand the mechanisms at play and their possible persistence. For instance, it is stated that SAM is influenced by ENSO in the austral summer. This interaction likely influences sea ice which is related to winter rainfall (with a 1-2 month lead). [Gwenaelle GREMION, Canada]	Accepted. The text of the SOD is written to recognize the seasonal distinctions.
21242	118	29	118	29	SAM is measure of the pressure gradient between the high and mid-latitudes. [Gwenaelle GREMION, Canada]	Accepted. Text revised.
32566	118	30	118	30	Isn't the SAM a shifting of the mid-latitude jet as opposed to the sub-tropical jet? [Isla Simpson, United States of America]	Noted. Reason and Rouault explicitly state "subtropical jet"

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32568	118	32	118	36	It seems like Seager et al 2019, J. Clim, 32, 2887-2915 might be relevant to this discussion. They show that for interannual variability the hemispheric SAM doesn't really show up in connection to South Africa rainfall anomalies. Rather, it's more local circulation anomalies. [Isla Simpson, United States of America]	Accepted. This point Included in the text
21244	118	33	118	33	Does (see below) refer to Figure 10.29? [Gwenaelle GREMION, Canada]	Taken into account. Text refers to statements in a later subsection.. Reference to that section added.
21246	118	40	118	40	The statement that ENSO affects SAM mostly in summer is far too broad. El Ninos versus La Ninas can have a different seasonal impact on SAM. Futhermore, East Pacific versus Central Pacific events manifest on SAM in different seasons (see Wilson et al., 2016, J. Climate). [Gwenaelle GREMION, Canada]	Taken into account. Discussion on the role of ENSO has been moved to a separate paragraph. However, there is little sense to expand that discussion considerably, since it pertains to relationships (especially in the east and central Pacific(that are clearly second-order for the topic at hand.
21248	118	48	118	54	The South Atlantic anticyclone is also influenced by ENSO (see Clem et al., 2018, JGR-Atmos.) [Gwenaelle GREMION, Canada]	Accepted. This point is Included in a reworked paragraph on ENSO.
21250	118	54	118	54	Reference should be Sousa et al., 2018a [Gwenaelle GREMION, Canada]	Noted. There is only one Sousa et al. in reference list. This is thus OK. Other references have been corrected.
21252	119	5	119	6	Philippon et al., 2012 focuses on May-July rainfall [Gwenaelle GREMION, Canada]	Accepted. Corrected.
21254	119	5	119	6	This sentence would fit better in a previous paragraph which discusses ENSO's influence on SAM. [Gwenaelle GREMION, Canada]	Accepted. The sentence has been moved and some rephrasing in the paragraph above has been done.
21256	119	16	119	16	It is unclear how Figure 10.28 is relevant to this text. [Gwenaelle GREMION, Canada]	Taken into account. This should have been fig 10.29. Text corrected and some explanatory text added to go with the revised figure (10.24).
21260	119	24	119	24	The MacKellar et al., 2014 reference does show mixed sign in total rainfall trends, but does seem seasonally consistent in fewer rain days. It might be worth mentioning. [Gwenaelle GREMION, Canada]	Noted. Yes, there is some consistency, but only in DJF which is irrelevant from the point of view of drought. JHA trends in rain days are still mixed.
21258	119	24	119	26	Sousa et al., 2018a indicate a drying trend in the transition seasons in the post-1979 period. The Wolski et al., 2019 reference is currently unavailable, so this post-1981 period cannot yet be corroborated. [Gwenaelle GREMION, Canada]	Taken into account. There is no inconsistency between Wolski and Sousa. The latter assesses trend in April-September. There was some confusion about seasons, which is now corrected.
21262	119	27	119	27	The MacKellar et al., 2014 reference calculates the 0.3°C/decade trend in maximum temperature. [Gwenaelle GREMION, Canada]	Noted. They also describe identical trends also in tmin. Because the tmin and tmax trends are not different, it does not make sense to describe them separately. In addition, temperatures are only marginally significant from the drought perspective.
21264	119	31	119	33	The statement about the core and tails of the rainy season is a bit confusing. Mahlalela et al., 2018 show that the CMIP5 models tend to exaggerate the peak of the wet season with overestimated precipitation in mid-winter and a dry bias in the transition seasons. [Gwenaelle GREMION, Canada]	Taken into account. Not sure if this comment pertains to terms "core" and "tails", or to the fact that the differences are not described in detail. Changed both.
21266	119	33	119	35	In Figure 10.29, it is difficult to see the CMIP5 decline in rainfall for the post-1960s period as the text suggests. The decline appears to begin after 2020 in the figure. [Gwenaelle GREMION, Canada]	Taken into account. A figure illustrating trends has been added for clarity.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
32570	119	33	119	35	It's really difficult to tell this from the figure. Perhaps a pdf of trends could be plotted instead? [Isla Simpson, United States of America]	Taken into account. A figure illustrating trends has been added for clarity.
51220	119	42	47	42	This statement on underestimation of observed trends is in contrast with the notion just made that many models overestimate the downward precipitation trend in the Capetown cases tudy [Bart Van den Hurk, Netherlands]	Noted. This statement does not refer to rainfall trends, but to trends in large scale circulation indices.
21268	119	43	119	44	Lim et al., 2016b suggest that CMIP5 models do NOT capture SAM trends well. "The SAM trend in the warm seasons is also significantly underestimated in these historical run as reported in Zheng et al. [2014] (Figure 3b). The seasonality and magnitude of the observed SAM trend is only captured in five models..." Five out of 37 models. [Gwenaelle GREMION, Canada]	Accepted. Statement about trends was in error. Trends are underestimated, as mentioned earlier. Corrected.
21270	119	44	119	45	It is unclear whether the statement "particularly in March to May" refers to accurately capturing trends and SAM relationship to rainfall, or if autumn is the inconsistent season in which trends or relationships are not captured well. [Gwenaelle GREMION, Canada]	Accepted. The statement about trends was in error, and the sentence was rephrased to make it clearer.
32572	120	16	119	16	"increase in the SAM" is ambiguous. I think what is meant here is anomalies that project onto the positive phase of the SAM or a shift toward a more positive phase. But the statement suggests more SAM variability. Suggest rewording. [Isla Simpson, United States of America]	Accepted. Text reworded.
21272	120	21	120	22	The Sousa et al., 2018a references suggests a weakening of the intensity of atmospheric rivers during the Cape Town drought, but I could not find anything about the frequency of atmospheric rivers. They do mention the decreased frequency of extratropical cyclones during the drought period. [Gwenaelle GREMION, Canada]	Accepted. Sentence deleted.
51222	120	43	18	50	It would be interesting to focus this discussion on how the statisitical method could give an opposite wetness signal from the (driving?) GCMs, i.e. a bit more substance on the noted importance of the interplay between dynamic and thermodynamic features [Bart Van den Hurk, Netherlands]	Noted. However, this behaviour, unfortunately, has not been investigated in detail and thus it is impossible to make any defensible statements. The current text acknowledges the difference, and makes a weak hypothesis about possible reasons for that disparity. It has been further weakened in the edit.
21274	120	45	120	48	Could the predictor variables mentioned here be stated outright? [Gwenaelle GREMION, Canada]	Noted. The cited paper does not explicitly address that question. It simply notes that the regional synoptic variables (some of which were used in the downscaling) explain only a small proportion of systematic variance in rainfall in Cape Town region.
51224	120	55	46	55	"migration" -> "change in north-south extent"? [Bart Van den Hurk, Netherlands]	Accepted. Text reworded.
21276	121	5	121	5	The reference call to Fig. 11.3 in AR4 is confusing here. That Figure is related to precipitation in Africa, not Perth as this paragraph is discussing. Furthermore, it does not appear to illustrate step changes. [Gwenaelle GREMION, Canada]	Taken into account. Wrong reference, it should be Hennessy et al. 2007.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
51226	121	6	53	6	Apparently this is not a permanent drought situation, as the drought is also ending. "Semi-permanent" is better phrase. Could this be the result of a so-called Hurst-phenomenon, that is a step=wise oscillation of a coupled system where multiple time scales are at play, such as demonstrated for the Nile discharge time series in the '70's or so? [Bart Van den Hurk, Netherlands]	Noted. Thus the apostrophes around permanent drought. There appear to be no sources that would claim the dry phase is finished or finishing, and time series data available (from e.g. www.bom.gov.au) does not seem to suggest it. Indeed there are reports of “wetter” years, but those years are by far drier that wet years in the pre1970 period. In summary, there is no evidence that the decline is a part of a multi-decadal quasi-periodic behaviour.
21278	121	10	121	18	The paleo-perspective of the Cape Town drought is lacking. Other sources include: Stager et al., 2012, Clim Past; Hahn et al., 2016, Quat Int; Meadows et al., 2010, J. Arid. Env. [Gwenaelle GREMION, Canada]	Accepted: References added
21340	121	14	121	15	Please add as figure to these sentence to visualise for audience: increase in an easterly hot wind flowing off the edge of South Africa’s interior plateau, a weakening of the southern Benguela Current upwelling and Agulhas Current leakage into the southern Atlantic from the Indian Ocean. [Gwenaelle GREMION, Canada]	Rejected. A figure like this does not appear to be necessary considering the nature of this information, focused on an abrupt shift, which is not relevant to the overall context of this section. There is no figure illustrating this behaviour in Waldeab et al., for example,
51228	121	21	5	21	This storyline/narrative approach is actually providing an explanation of the observed and projected trends by focusing on drivers and mechanisms. It is a different interpretation of storylines than the "event storylines" that would focus on the event put in the context of a changing climate, and be focusing on the impacts and options for Cape Town would such an event unfold, in line with the Hazeleger (2015) and Shepherd (2018) discussions on storylines [Bart Van den Hurk, Netherlands]	Noted. Discussion in earlier sections, especially Section 5, point out that there are multiple uses of the term "storyline".
21280	121	33	121	37	Otto et al., 2018 investigates the probability of event under 2°C warming [Gwenaelle GREMION, Canada]	Accepted. Corrected.
43460	121	33	121	37	This statement should be expressed with the same confidence language as the rest of the report -- 95% ? [Saad Amer, United States of America]	Rejected. The statement here is about statistical confidence of a particular quantitative result and not an assessment statement that would use IPCC calibrated language.
51230	121	46	5	47	also the limited agreement between obs and modelled trends in the past decades is a counteracting element, I would say [Bart Van den Hurk, Netherlands]	Accepted. Statement added.
21338	121		121		Section:10.6.2.9. Might be better to add hints or superscript to the word Hadley cell. Generally, the Cape Town part is quite interesting, but "assessment summary" (section 10.6.2.10) is not clear described the results and outputs. For Indian section, I assume (generally) tough to read, due to enourmous of reference and less info. And construction of the sentences, it seems to me so "patchily". Indian section is trying to follow as Cape Town case, but more information looks like without indeed understanding. Section10.6.4.6, line 12-13, modelling this tools like CORDEX,etc., what they found it and what was difference among them (will be better to make comparison among weakness and strongest sides of each modul) [Gwenaelle GREMION, Canada]	Rejected. This comment covers multiple subsections, and it is not clear what point(s) the reviewer is trying to make. Statements made in the subsections are assessments based on available literature.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44050	122	11	122	11	Suggested text to add: "A UDA-based analysis of mean precipitation trends in the region at gridbox scale over 1901-2010 (Knutson and Zeng 2018) shows a mix of results with a few gridboxes having significant decreasing trends, a few more grid boxes with significant increasing trends, and much of the region having trends that are not distinct from expected levels of natural variability according to CMIP5 models (i.e., nondetectable trends)." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (see fig. 3c). [Thomas Knutson, United States of America]	Noted: The following sentence has been added to Section 10.6.3.3, which deals with observational issues for the region: “While trends for India over the extended period of 1901 to 2010 are inconclusive (Knutson and Zeng, 2018) the number of competing drivers acting over such a long period (see 10.6.3.5) makes this unsurprising.”
21282	122	20	122	21	The Stainforth, 2018 reference is not listed correctly in the references. Is this meant to be Dessai et al. 2018? [Gwenaelle GREMION, Canada]	Accepted: This reference was incorrectly listed as Stainforth due to an error in the record contained by the bibliography software. This has been corrected to Dessai et al. 2018 for the SOD submission.
21284	122	54	122	55	Guo et al. (2016) cite Kaskaoutis et al., 2012 and Babu et al., 2013 for the cooking fire attribution to sulphate and BC emissions. [Gwenaelle GREMION, Canada]	Accepted: In the SOD version we have replaced Guo et al. (2016) with several more appropriate references linking BC emissions to the use of domestic cooking fires in India.
43462	123	3	123	7	suggested term - Land Use Change https://www.ipcc.ch/report/land-use-land-use-change-and-forestry/ [Saad Amer, United States of America]	Accepted: The bullet has been revised to mention that the green revolution and its associated irrigation is an example of land-use change. The subsequent bullet on human migration/urbanisation has also been edited to mention land-use change.
21286	123	7	123	7	Koster et al., 2004 [Gwenaelle GREMION, Canada]	Accepted: The bibliography entry for this article has been adjusted to include the full author list.
43464	123	8	123	10	Suggested term - Human Migration [Saad Amer, United States of America]	Accepted: A more academic style of language has been incorporated in the SOD. The text: “the movement of large parts of the population” has been replace with “human migration”.
6233	123	11	123	11	arid and semi-arid desert dust emissions and dust-storms from [Mostafa Jafari, Iran]	Accepted: The suggested form of words has been added to the sentence for the SOD version.
21288	123	11	123	13	This bullet should be attributed to Vinoj et al., 2014, Nat. Geosci [Gwenaelle GREMION, Canada]	Accepted: The citation of Vinoj et al. has been added in reference to the role of dust as a natural driver of the monsoon.
46270	123	11	123	13	Dust in Iran is a temporary and seasonal phenomenon. Can such a phenomenon be effective in climate change? [sadegh zeyaeyan, Iran]	Noted: In the SOD we have reorganised the order of the bullets to place the role of dust directly beneath the discussion on other anthropogenic aerosols; a caveat has been added that it is the importance of dust’s interaction with back carbon the leads to its role as a potential driver of change in the monsoon.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
8904	123	11	123	13	Dust in Iran is a temporary and seasonal phenomenon. Can such a phenomenon be effective in climate change? [Mohammad Javad Zareian, Iran]	Noted: In the SOD we have reorganised the order of the bullets to place the role of dust directly beneath the discussion on other anthropogenic aerosols; a caveat has been added that it is the importance of dust's interaction with back carbon the leads to its role as a potential driver of change in the monsoon.
57546	123	11	123	13	Dust in Iran is a temporary and seasonal phenomenon. Can such a phenomenon be effective in climate change? [Sahar Tajbakhsh Mosalman, Iran]	Noted: In the SOD we have reorganised the order of the bullets to place the role of dust directly beneath the discussion on other anthropogenic aerosols; a caveat has been added that it is the importance of dust's interaction with back carbon the leads to its role as a potential driver of change in the monsoon.
21290	123	29	123	30	Pai et al. (2015) never cite the Shepard method. Also "Shepherd" is misspelled assuming they are referring to the Shepard interpolation (Shepard, 1968, ACM Natl. Conf.) [Gwenaelle GREMION, Canada]	Rejected (although misspelling accepted): Whether Pai "cite" the Shepard method is not relevant. The point is whether the data they have used as a basis for their findings employs this method in its construction. While the Pai et al. (2015) reference listed in the FOD described the results derived from the rainfall data and did not mention details of the Shepard method directly, an earlier methodological paper details the construction of the dataset (Pai et al., 2014, Mausam). That work makes clear reference to the Shepard method (see its Table 1, on the last line) has now also been cited in the SOD.
51232	123	30	7	30	what is Shepherd's method? [Bart Van den Hurk, Netherlands]	Accepted: A few words have been added to explain that Shepard's method is an interpolation method designed to grid input data that is irregularly spaced. The reference to Shepard (1968) has also been added.
39430	123	51	124	12	Takahashi et al. (2018) also indicated the decrease in precipitation over South Asia by aerosol forcing using by a different model from the cited there. In addition, they discussed the uncertainties on aerosol-cloud interaction, because the uncertainties of the interaction may change the sign of the long-term trends in precpitation. Better to cite here. Ref. Takahashi, H.G., Watanabe, S., Nakata, M., and Takemura, T. 2018: Response of the atmospheric hydrological cycle over the tropical. Progress in Earth and Planetary Science (PEPS), 5, 44, https://doi.org/10.1186/s40645-018-0197-2. [Hiroshi Takahashi, Japan]	Accepted: The reference to Takahashi has been included here to support the findings; a further sentence has been added in the next paragraph to discuss aerosol uncertainty, along with other studies of the same.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21292	124	5	124	7	Bollasina et al., 2011 do not provide much certainty for the hemispheric asymmetry mechanism. [Gwenaelle GREMION, Canada]	Noted: We are not too sure of the detail of the referee's concern since no detail is given as to why there is not much certainty (the paper's authors do not describe this mechanism as uncertain). Nevertheless, we acknowledge that the paper is based on a single model and therefore we have added this caveat to the discussion in the SOD version. In addition, we have also changed the wording slightly to refer to moisture transport towards India.
21294	124	14	124	15	Blamed for what? This statement is unclear. [Gwenaelle GREMION, Canada]	Accepted: The text, "for declining Indian rainfall over the historical period" has been appended to the existing sentence to clarify the event in question. (Although to be pedantic, it should be clear from the subsection title that we are referring to drying over the historical period.)
51234	124	37	7	39	Can a regional land use change experiment credibly detect an impact on monsoon dynamics, which essentially is driven by large-scale features probably not captured in WRF? [Bart Van den Hurk, Netherlands]	Rejected: The discussion here is clear that local patterns of land-use change are used to force the WRF model within its domain. Without any other change in forcing outside the model domain, the LU changes induce reductions in monsoon rainfall of order millimetres/day. The study mentions nothing of monsoon dynamics, and nor did our assessment of this paper. We have added an explanation that the mechanism relates to a reduction in local evapotranspiration.
51236	124	42	124	42	0.5 mm/day for India as a whole, or only the irrigated region? [Bart Van den Hurk, Netherlands]	Accepted: 0.5mm/d is a rough estimate for the country as a whole (see Figure 1 in Cook et al. (2015), reproduced in McDermid et al., 2017). A very large proportion of India is irrigated. The text has been clarified in the SOD to mention that parts of the country feature 0.5mm/day irrigation, although the value is higher than this in summer. The Cook et al. (2015) paper has also been cited here.
21296	124	43	124	43	This reference should be Cook et al., 2015b [Gwenaelle GREMION, Canada]	Accepted: The correct Cook et al. paper has been cited in the revised text for the SOD and included in the reference list.
21298	125	9	127	39	Sections 10.6.3.6 and 10.6.3.7 could be woven a bit into a more cohesive story rather than each paragraph containing excerpts from one individual study. [Gwenaelle GREMION, Canada]	Accepted: These sections have been written in a more cohesive manner in the SOD.
21300	125	11	125	12	The AR5 suggested "medium confidence" in the increase in Indian monsoon precipitation. Is that the same category as "likely"? [Gwenaelle GREMION, Canada]	Rejected: The reviewers have conflated two different sets of language of confidence and likelihood.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43394	126	10	126	11	This sentence may cite the paper of Endo et al. (2018) a little bit incorrectly. According to their paper, the monsoon westerlies in the lower troposphere shift northward and strengthen over land including South Asia, but the westerlies slightly weaken on the whole (paragraph 2 of section 3.1 of the paper). So, I suggest the following description: “In coupled experiments, lower tropospheric monsoon winds are found to move northwards and strengthen over land, in response to the stronger land-sea temperature contrast in RCP8.5 experiments.” [Hirokazu Endo, Japan]	Accepted: The text has been revised in the SOD submission exactly as the reviewer has suggested.
50406	126	35	126	35	other downscaling studies over India: Sørland et al. 2015, DOI:10.1007/s00382-015-2850-4; Sørland et al. 2016,DOI:10.1002/2015JD024658 [Silje Soerland, Switzerland]	Accepted: These studies have been added to the paragraph discussing future projections in dynamical downscaling.
54566	127	3	127	4	Here the rae occurrence of the use of 'added value' in the context of statistical downscaling. Yet stat downscaling is not really discussed in any of the added value discussions. Why is that. Does it not exist, or is it known by a different term. The way the chapter is written now, one can be left with the impression that statistical downscaling has no added value. [Linda Mearns, United States of America]	Noted: Following discussion with Lead Authors of Chapter 10 who are expert in statistical downscaling, the use of the phrase “added value” in discussing SD is to be avoided. Thus, the sentence has been removed from the SOD.
26226	127	33	127	35	Following text may be added here. A high resolution AGCM, which resolve Western Ghats orogaphy well, projects a decrease in precipitation along the southwestern India in future (Rajendran et al., 2012, 2013). Rajendran, K., Kitoh, A., Srinivasan, J., Mizuta, R., and Krishnan, R. (2012). Monsoon circulation interaction with Western Ghats orography under changing climate. Theor. Appl. Climatol., 110, 555-571. doi:10.1007/s00704-012-0690-2. Rajendran, K., Sajani, S., Jayasankar, C. B., and Kitoh, A. (2013). How dependent is climate change projection of Indian summer monsoon rainfall and extreme events on model resoltuion? Curr. Sci. 104, 1409-1418. [Akio Kitoh, Japan]	Noted. These two papers have been assessed during the preparation of the SOD. After assessment, the paper Rajendran et al. (2013, Current Science) has not been included in the SOD since it omits crucial information that prevents reliable conclusions being drawn from the displayed results. The paper claims that the highest resolutions are required to yield reliable future projections of climate change (in precipitation patterns) for India. It is undoubtedly true that resolution adds spatial detail to the representation of precipitation patterns (which has already been discussed in Section 10.6.3). However, from the paper it is not possible to make any mechanistic judgement as to why changes may be different. Does the monsoon circulation change with model version? Does the change in monsoon circulation in the future depend on model version and does that explain the pattern of rainfall change? It is not possible to tell, since no diagnostics of monsoon wind are presented in the paper. Furthermore, the paper shows that at the highest (“S” ~20km) resolution, the precipitation change is extremely sensitive to the choice of convection scheme (see Figure 5 therein), since the precipitation change over the central west coast has a different sign under the different schemes! It is curious as to why the two convection schemes have not been compared also for the pattern of rainfall
56686	128	38			don’t forget to assess also the Mediterranean rivers, aersols and sea, not only the climate evolution over land [Samuel Somot, France]	Rejected. Focus is on land. Rivers, aerosols are only discussed when relevant for evolution over land.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
21302	128	42	128	54	Copy-pasted from Cramer et al., 2018 [Gwenaelle GREMION, Canada]	Taken into account. Text adapted and reference made to Cramer et al. 2018
32574	129	13	129	13	I don't think it's correct to state that the large scale subsidence is associated with the downward branch of the Hadley cell. It's not simply due to the overturning circulation, Rodwell and Hoskins (1996), Q. J. R. Meteorol. Soc., 122, 1385-1404 demsonstrated the importance of the circulation induced by monsoon heating over Asia and Simpson et al (2015), J. Clim., 28, 1977-1996 emphasize the importance of the circulation anomalies induced by topography in the middle-east as well. [Isla Simpson, United States of America]	Accepted. Text changed
56492	129	37	129	42	This requires revision. Clearly the warming has been faster than the global mean, but the difference appears consistent with land versus ocean and the Mediterranean Warming (which is also present in most climate models). Global warming has been about 1 deg, and warming over land about twice that. The warming mentioned (1.4 deg) does not sound as out of the normal. So the extra warming is not surprising. [Christoph Schär, Switzerland]	Accepted. Text changed.
21304	129	39	129	40	Unclear for how many decades this rate of warming has occurred. "Since 1985, the surface of the… 0.4°C each decade." or something like that. [Gwenaelle GREMION, Canada]	Accepted. Text changed
56494	129	44	129	51	This is a biased assessment. It completely ignores many studies that have linked the Mediterranean Amplification to dynamical / thermodynamic changes of the atmospheric circulation. Studies to be covered include Joshie al. 2008 (https://doi.org/10.1007/s00382-007-0306-1), Byrne and O'Gorman 2013 (https://doi.org/10.1175/JCLI-D-12-00262.1; 2013, https:// doi.org/10.1002/grl.50971) who have linked the Med. Amplification to land-sea contrast, or studies that invoke lapse-rate changes (Kröner et al. 2017, http://dx.doi.org/10.1007/s00382-016-3276-3; Brogli et al., 2019, https://doi.org/10.1175/JCLI-D-18-0431.1) [Christoph Schär, Switzerland]	Accepted. Agree that this mechanism is not discussed properly. Text has been revised and references included.
21306	129	48	129	52	Is the Crippa et al., 2016 reference relevant to this statement abou enhanced warming through cloud properties? [Gwenaelle GREMION, Canada]	Taken into account. The Crippa reference is about European air quality, but does not discuss the impact on warming. Therefore the reference is removed.
44052	129	53	129	53	Suggested text to add: "A UDA-based analysis of observed vs. modeled surface temperature trends at gridbox scale over 1901-2010 (Knutson et al. 2013) shows for the Mediterranean region observed warming trends that are detectable (highly unusual compared to CMIP5 simulated natural variability) and partly attributable to anthropogenic forcing (being either consistent with or greater than simulated by the CMIP5 model runs that included both anthropogenic and natural forcings. Reference: Knutson, T.F. , Zeng, and A. Wittenberg (2013), Multimodel Assessment of Regional Surface Temperature Trends: CMIP3 and CMIP5 Twentieth-Century Simulations. J. Climate, v. 26, pp. 8709-8743 (see Figs. 10). [Thomas Knutson, United States of America]	Accepted. Text added
21308	129	55	130	1	This statement should be attributed to Seneviratne et al., 2006 rather than Zampieri et al., 2009. [Gwenaelle GREMION, Canada]	Accepted. Review comment is correct. Revised

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
27460	129		129		10.6.4.4 In the section “Warming over the historical period”, there is no mention of the southern part of the Mediterranean although the region is showing important warming also faster than the global mean in recent decades [Fatima Driouech, Morocco]	Taken into account. Same comment as ID 27446
27446	129				10.6.4.4 In the section “Warming over the historical period”, there is no mention of the southern part of the Mediterranean although the region is showing important warming also faster than the global mean in recent decades [Fatima Driouech, Morocco]	Taken into account. The section discusses now more extensively the Southern Mediterranean.
48872	129				"The Mediterranean has a semi-arid climate" is not appropriate.Though one could say that a fraction of the areas around the Mediterranean (expecially along its southern coast) are semi-arid (see figure 1 of https://doi.org/10.1016/B978-0-12-416042-2.00012-4) [piero lionello, Italy]	Accepted. Text changed
31712	130	9			Other key mechanisms are the enhanced land-sea temperature contrast which leads to Relative Humidity and Soil Moisture feedbacks, eg. Rowell and Jones (2006). Rowell, D.P. and Jones, R.G., 2006: Causes and uncertainty of future summer drying over Europe. Climate Dynamics, 27, 281-299 [Dave Rowell, United Kingdom (of Great Britain and Northern Ireland)]	Accepted. Text modified and reference added.
21310	130	14	130	16	Remove Cramer et al., 2018 reference as they cite Lionello and Scarascia, 2018. [Gwenaelle GREMION, Canada]	Accepted. Reference removed.
44054	130	44	130	44	Suggest to add: "A UDA-based analysis of mean precipitation trends in the Mediterran region at gridbox scale over 1901-2010 (Knutson and Zeng 2018) shows fairly coherent broad-scale pattern of detectable anthropogenic decreasing trends. Along with northern tropical Africa, this is one of the most prominent examples of large-scale century-scale detectable and attributable decreasing precipitation trends (drying trends) anywhere in world." Reference: Knutson, T.R. and F. Zeng, 2018: Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends. J. Climate, 31, 4617–4637, https://doi.org/10.1175/JCLI-D-17-0672.1 (see fig. 3c). [Thomas Knutson, United States of America]	Taken into account. Same comment as ID 44052
21312	130	51	130	53	Not sure the Mariotti et al., 2015 reference is correct as it makes no mention of the Asian and African monsoons, nor Hadley circulation. [Gwenaelle GREMION, Canada]	Taken into account. Reference to Mariotti is not correct and is deleted.
51238	131	3	21	49	This section overlaps partly with the Atlas.5.6.3.2 material [Bart Van den Hurk, Netherlands]	Taken into account. The present overlap is not disturbing.
6798	131	5	131	49	There are also statistical downscaling studies for this area, which can be used to further strenghten information on future regional climate change. In general, statistical downscaling confirms the results obtained from GCM and RCM studies, however with some regional variations. An overview on statistical downscaling results for the Mediterranean area is given for instance by Jacobeit et al. (2014). With respect to future droughts a reference is Hertig & Tramblay (2016). References: Jacobeit, J., Hertig, E., Seubert, S., Lutz, K. (2014): Application of statistical methods for regional climate change projections in the Mediterranean area. Reg. Environ. Change 14(5), 1891-1906. Hertig, E., Tramblay, Y. (2016): Regional downscaling of Mediterranean droughts under past and future climatic conditions. Global and Planetary Change. DOI: 10.1016/j.gloplacha.2016.10.015 [Elke Hertig, Germany]	Accepted. The added information of statistical downscaling is included with the suggested references
21314	131	22	131	23	The frequency and severity of marine heat waves are projected to increase [Gwenaelle GREMION, Canada]	Taken into account. Frequency is added to sentence

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45096	131	38	131	39	CORDEX MENA region also covers the Mediterranean region and adding the results from that region can improve the GCM/RCM matrix for the area. Zittis, G., Hadjinicolaou, P., 2017. The effect of radiation parameterization schemes on surface temperature in regional climate simulations over the MENA-CORDEX domain. Int. J. Climatol. 37 (10), 3847–3862. Zittis, G., Hadjinicolaou, P., Lelieveld, J., 2014. Comparison of WRF model physics parameterizations over the MENA-CORDEX domain. Am. J. Clim. Chang. 3, 490–511. T. Ozturk, M. T. Turp, M. Turkes, and M. L. Kurnaz, "Future Projections of Temperature and Precipitation Climatology for CORDEX-MENA Domain Using RegCM4.4", Atmospheric Research 206, 87-107 (2018). Almazroui, M., 2016. RegCM4 in climate simulation over CORDEX-MENA/Arab domain: selection of suitable domain, convection and land-surface schemes. Int. J. Climatol. 36, 236–251. http://dx.doi.org/10.1002/joc.4340. Almazroui, M., Islam, M.N., Al-Khalaf, A.K., Saeed, F., 2015. Best convective parametrization scheme within RegCM4 to downscale CMIP5 multi-model data for the CORDEX-MENA/Arab domain. Theor. Appl. Climatol. 124, 807–823. Almazroui, M., Islam, M.N., Alkhalaf, A.K., Saeed, F., Dambul, R., Rahman, M.A., 2016. Simulation of temperature and precipitation climatology for the CORDEX-MENA/Arab domain using RegCM4. Arab. J. Geosci. 9 (1), 1–13. Bucchignani, E., Cattaneo, L., Panitz, H.J., Mercogliano, P., 2016. Sensitivity analysis with the regional climate model COSMO-CLM over the CORDEX-MENA domain. Meteorog. Atmos. Phys. 128, 73–95. [Levent Kurnaz, Turkey]	Rejected. None of these papers belong to this section. A few have been added to the evaluation section (10.3.2.5): Zittis, G., Hadjinicolaou, P., 2017; Almazroui, M., 2016; Bucchignani, E., Cattaneo, L., Panitz, H.J., Mercogliano, P., 2016.
21316	131	43	131	45	Déqué et al. (2012) also suggest the GCM choice is not the main element of uncertainty for summer precipitation. Is that worth noting? [Gwenaelle GREMION, Canada]	Accepted. Note : here we are speaking about warming, not really precipitation, but the comment appears relevant.
27448	131				10.6.4.6 In the section "Messages from downscaling studies" there is a clear lack of assessment for the southern part of the Mediterranean. Please remediate to this gap. [Fatima Driouech, Morocco]	Taken into account. Southern Mediterranean is now included in the assessment
21318	132	1	132	4	Barredo et al. (2018) also report a ~50% expansion of the Mediterranean climate zone. [Gwenaelle GREMION, Canada]	Accepted. Text is modified.
56496	132	3	132	3	I assume that this relates to the land area, please clarify [Christoph Schär, Switzerland]	Accepted Text is revised.
50408	132	18	132	19	The study of Kröner et al. 2016. doi: https://doi.org/10.1007/s00382-016-3276-3 and Brogli et al. 2019: https://doi.org/10.1175/JCLI-D-18-0431.1 is also investigating the importance of different drivers on the Mediterranean climate [Silje Soerland, Switzerland]	Accepted. References are added.
21320	132	19	132	23	Manzini et al., 2014, JGR: Atmos. identified those drivers which were then used by Zappa and Shepherd (2017). [Gwenaelle GREMION, Canada]	Accepted. Reference added.
32576	132	22	132	22	Simpson et al 2018, J. Clim., 31, 6371-6391 have also discussed the influence of the polar vortex change on Mediterranean precipitation change. Perhaps this is a relevant citation here. [Isla Simpson, United States of America]	Accepted. Reference added.
51240	132	23	40	28	this set of lines is not linked to the Mediterranean and should be deleted, or merged with appropriate material elsewhere in this chapter or Atlas [Bart Van den Hurk, Netherlands]	Accepted. Text is revised.
51242	132	31	40	45	The last sentence of this summary can be deleted. And a reference to the desertification trend should be included in this assessment summary [Bart Van den Hurk, Netherlands]	Taken into account. Last sentence is deleted, but no reference is included in the assessment summary.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
44056	132	39	132	40	Suggest to add here: "One reason for the high confidence in projected future drying is the finding of prominent detectable and at least partly attributable (to anthropogenic forcing) century-scale decreasing precipitation trends in the region." [Thomas Knutson, United States of America]	Accepted Text and reference added.
39668	133	30	133	30	Figure 1 of FAQ 10.1 is nice in easily showing what "distillation" means, it does not help to understand "how" the process actually works. The text of the FAQ 10.1 does not provide a discussion about the actual process either. It would be desirable if that it is explained with some more detail. [Carolina Vera, Argentina]	Accepted : Text added to explain the process (e.g., using data, information from multiple sources, assessing physical realism, recognizing the range of plausible behaviours in that light, tailoring to the expressed needs and values of the stakeholders involved).
21322	133	38	133	42	The example involving Arizona's conservative government is disconcerting to me, primarily the statement about avoiding the motivation of fighting climate change. I understand the need to provide climate information to address a particular problem like water resource issues, but to advocate avoiding climate change in order to address those issues feels like a slippery slope. [Gwenaelle GREMION, Canada]	Noted : The discussion in the paragraph (and really the FAQ) is about how to be effective with climate information and recognizes that the political process is not always motivated purely by scientific information.
36660	133	48	133	48	Remove "receiving". [Seth McGinnis, United States of America]	Accepted
43466	133		133		It would be useful to enumerate some factors that make climate models useful, like their impacts on regional economies, water availability, impacts on agriculture/food security, human migration, intergenerational wealth, etc. [Saad Amer, United States of America]	Accepted within the limits space allows.
43468	133		133		It may be useful to list some relevant stakeholders as it is difficult to assess how useful RCMs are without acknowledging potential groups they may be useful to. [Saad Amer, United States of America]	Accepted within the limits space allows.
48828	135	3			The sentence in FAQ 10.2: “Tall buildings in close proximity to each other ‘trap’ heat, creating a so-called urban heat island’, which causes cities to experience higher than average temperatures than their surrounding areas” is a simplified and non-totally correct idea of UHI. Moreover, being in a FAQ, could lead to misunderstanding by a non scientific public. Please consider rephrasing the sentence to something like: “Dense urban areas can modified the radiation and heat fluxes, that combined with less vegetation, poor ventilation and the massive anthropogenic heat release can lead to the so-called urban heat island’, which causes cities to experience higher than average temperatures than their surrounding areas”. [António Lopes, Portugal]	Taken into account. Text has been modified for the SOD.
32578	135	8	135	9	Is this really a fair way to state the role of cities. I would have thought that per-preson, cities are responsible for less emissions than other areas. I’m not an expert though. Perhaps some statement could be made regarding this. People might come away from this statement thinking that it’s better for the environment to not live in cities and I’m not sure that’s true. [Isla Simpson, United States of America]	Noted. This statement is related to the surface areas of the cities which is less than 1% and not to the population density.
30060	135	33	135	38	This makes it sound like the main problem with the UHI effect is that it messes up our climate data records. But surely the main problem is that it exacerbates the effects of climate change. In the spirit of this chapter, the UHI effect should be treated as one of the multiple causal factors that are involved in extreme events, and the total effect should be understood in this context. [Theodore Shepherd, United Kingdom (of Great Britain and Northern Ireland)]	Taken into account. Text revised.
14120	135	43	135	43	Consider shortening "the global climate change warming" -> "the global warming" [Jinwon Kim, Republic of Korea]	Accepted

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
43470	135		135		It may be useful to note that many cities exist near water and are susceptible to flooding/sea level rise Hallegatte, Stephane, Green, Colin, Nicholls, Robert J., Corfee-Morlot, Jan. Future flood losses in major coastal cities. Nature Climate Change. 2013/08/18/online Vol 3 802. Nature Publishing Group. https://doi.org/10.1038/nclimate1979. 10.1038/nclimate1979 . https://www.nature.com/articles/nclimate1979 [Saad Amer, United States of America]	Taken into account. The sea level rise impact on cities is now discussed in the urban box of the SOD
21324	140	57	140	59	I believe this is the incorrect reference, and the correct reference is Blamey et al., 2018 "The Influence of Atmospheric Rivers over the South Atlantic on Winter Rainfall in South Africa." J. Hydrometeorol. [Gwenaelle GREMION, Canada]	Accepted. Paper cited correctly for the SOD.
30232	145	12	145	13	Replace with: Christensen, J.H., Larsen, M.A.D., Christensen, O.B., Drews, M. and Stendel, M. (2019). Robustness of European climate projections from dynamical downscaling Clim. Dyn. https://doi.org/10.1007/s00382-019-04831-z [Ole B. Christensen, Denmark]	Accepted
30234	145	14	145	15	Delete; this is identical to Matte et al. (2019) [Ole B. Christensen, Denmark]	Accepted
21326	151	36	151	38	2019 (not 2018) publication in Climate Dynamic; also update issue and page numbers [Gwenaelle GREMION, Canada]	Accepted
21328	160	15	160	16	Huang et al., 2018 Nat Clim Change reference could not be found. Is it still under review? [Gwenaelle GREMION, Canada]	Accepted. The reference does not exist as such and the corresponding text was removed from 10.4.2.1 and 10.6.3.5
14086	163	33	163	33	Add a reference: "Kim, J., Sanjay, J., Mattmann, C., Boustani, M., Ramarao, M. V. S., Krishnan, R., and Waliser, D. E. (2015) Uncertainties in estimating spatial and interannual variations of precipitation climatology in the India-Tibet region from multiple gridded precipitation datasets. Int. J. Climatol., 35, 4557-4573." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
14088	163	33	163	33	Add a reference" "Kim, J., and Park, S. K. (2016) Uncertainties in calculating precipitation climatologies in East Asia. Hydrol. Earth Syst. Sci., 20, 651-658." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
14102	163	33	163	33	Add a reference: "Kim, J., Waliser, D. E., Mattmann, C. A., Goodale, C. E., Hart, A. F., Zimdars, P. A., Crichton, D. J., Jones, C., Nikulin, G., Hewitson, B., Jack, C., Lennard, C., and Favre, A. (2014) Evaluation of the CORDEX-Africa multi-RCM hindcast: systematic model errors. Clim. Dyn., 42, 1189-1202." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
14106	163	33	163	33	Add a reference: "Kim, J., Guan, B., Waliser, D. E., Ferraro, R. D., Case, J. L., Iguchi, T., Kemp, E., Putman, W., Wang, W., Wu, D., and Tian, B. (2018) Winter precipitation characteristics in western United States related to atmospheric river landfalls: observations and model evaluations. Clim. Dyn., 50, 231-248. doi 10.1007/s00382-017-3601-5." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
14110	163	33	163	33	Add a reference: "Kim, J., Kim, J., Farrara, J. D., and Roads, J. O. (2005) The effects of Gulf of California SSTs on warm-season rainfall in the southwestern United and northwestern Mexico: A regional model study. J. Climate, 18, 4970-4992." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
14116	163	33	163	33	Add a reference: "Kim, J., Guan, B., Waliser, D. E., Ferraro, R. D., Case, J. L., Iguchi, T., Kemp, E., Putman, W., Wang, W., Wu, D., and Tian, B. (2018) Winter precipitation characteristics in western US related to atmospheric river landfalls: observations and model evaluations. Clim. Dyn. 50, 231-248. DOI 10.1017/s00382-017-3601-5." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
14118	163	33	163	33	Add a reference: "Kim, J., Waliser, D. E., Neiman, P. J., Guan, B., Ryoo, and J., Wick, G. A. (2013) Effects of atmospheric river landfalls on the cold season precipitation in California. Clim. Dyn. 40, 465-474. DOI 10.1017/s00382-012-1322-3." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
21330	164	29	164	30	Koster reference should include coauthors. [Gwenaelle GREMION, Canada]	Noted. The Mendeley entry has been modified
14096	165	61	165	61	Add a reference: "Kyriakidis, P.C., Miller, N.L., and Kim, J. (2001) Uncertainty propagation of regional climate model precipitation forecasts to hydrologic impact assessment. J. Hydrometeorol., 2, 140-160." [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
21332	169	37	169	37	This reference should be Pienaar, L., and Boonzaaier, J. [Gwenaelle GREMION, Canada]	Accepted. Authors of document corrected for the SOD.
14082	175	17	175	17	Add a reference: 'Myung, B., Kim, S. E., Kim, J., and Kafatos, M. (2017) On the relationship between spring NAO and snowmelt in the upper southwestern United States. J. Climate, 30, 5141-5149.' [Jinwon Kim, Republic of Korea]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
21334	187	29	187	31	This ERL paper is authored by Dessai [Gwenaelle GREMION, Canada]	Accepted
13970	188	7	188	10	"Su, F., Duan, X., Chen, D., Hao, Z., and Cuo, L. (2012). Evaluation of the Global Climate Models in the CMIP5 over the Tibetan Plateau. J. Clim. 26, 3187–3208. doi:10.1175/JCLI-D-12-00321.1. Su, Z., Timmermans, W., Zeng, Y., et al. (2018). An overview of European efforts in generating climate data records. Bull. Am. Meteorol. Soc., 99(2), 349–359. doi: 10.1175/BAMS-D-16-0074.1. Sun, L., Deser, C., and Tomas, R. A. (2015). Mechanisms of Stratospheric and Tropospheric Circulation Response to Projected Arctic Sea Ice Loss. J. Clim. 28, 7824–7845. doi:10.1175/JCLI-D-15-0169.1." [Jun Wen, China]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
13972	195	61	196	4	"Yang, H., Jiang, Z., and Li, L. (2016a). Biases and improvements in three dynamical downscaling climate simulations over China. Clim. Dyn. 47, 3235–3251. doi:10.1007/s00382-016-3023-9. Yang, J., Zhang, ZQ., Wei, CY., Lu, F., Guo, Q. (2017). Introducing the new generation of Chinese geostationary weather satellites, Fengyun-4. Bull. Am. Meteorol. Soc., 98(8), 1637–1658. doi: 10.1175/BAMS-D-16-0065.1. YANG, K., WATANABE, T., KOIKE, T., LI, X., FUJII, H., TAMAGAWA, K., et al. (2007). Auto-calibration System Developed to Assimilate AMSR-E Data into a Land Surface Model for Estimating Soil Moisture and the Surface Energy Budget. J. Meteorol. Soc. Japan. Ser. II 85A, 229–242. doi:10.2151/jmsj.85A.229." [Jun Wen, China]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
13974	197	12	197	16	"Zhou, B., Zhai, P., Chen, Y., and Yu, R. (2018a). Projected changes of thermal growing season over Northern Eurasia in a 1.5 °C and 2 °C warming world. Environ. Res. Lett. 13, 035004. doi:10.1088/1748-9326/aaa6dc. Zhou, J., Wen, J., Liu, R., Wang, X., Xie, Y. (2018). Late spring soil moisture variation over the Tibetan Plateau and its influences on the plateau summer monsoon. Int. J. Climatol., 12, 4597–4609. doi: 10.1002/joc.5723. Zhou, S., Huang, G., and Huang, P. (2018b). Changes in the East Asian summer monsoon rainfall under global warming: moisture budget decompositions and the sources of uncertainty. Clim. Dyn. 51, 1363–1373. doi:10.1007/s00382-017-3959-4. " [Jun Wen, China]	Rejected. The reviewer does not provide a specific location in the chapter where the paper would be relevant to cite.
21336	197	34	197	35	Zickfeld reference should include coauthors. [Gwenaelle GREMION, Canada]	Noted. The Mendeley entry has been modified

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
45518	199	1	199	1	I could not find what "UC-Models" mean? I also wonder why do we include LES when they are not used to generate regional climate information. Maybe it should say "processes explicitly included" because GCMs also include plumes for example (although in an implicit way). [Di Luca Alejandro, Australia]	Taken into account: Explanation of all acronyms has been inserted in the figure.
36662	199	4	199	5	In the figure, change "Hires" to "Hi-res". "Hires" looks like a form of the verb "to hire". [Seth McGinnis, United States of America]	Taken into account: We changed "Hires" to "Hi-res"
38538	199	4	199	5	In Fig. 10.1, the range of the HighResMIP should be widen to higher resolution. Some models participating in HighResMIP has horizontal resolution of 25km and the smallest is 14km. This figure should be consitent with Fig. 7.8 of AR5. [Masaki Satoh, Japan]	Taken into account. However, we are careful with extending these ranges because we try to convey the idea that grid size is different from effective resolution, which tends to be about 4 times larger than that of the grid interval. And here we accept the regulation in High-RES MIP. We understand that some sophisticated high-resolution GCM can be driven by 800m resolution.
30280	199		205		Most of the figures' resolution is very low [Nazan An, Turkey]	Noted
35376	200	0	200	0	Figure 10.2: It is suggested to include the Lat/Lon information of the regions given in grey boxes so that in future more RCMs can use these domains to analyze their model performances. [Mehwish Ramzan, Pakistan]	Rejected. Due to other review comments it was decided not to provide the lat-lon.
9186	201	3	201	4	This graph also demonstrates that Arctic ice melt substantially halted in 2007, as in comment 17 above. [Jim O'Brien, Ireland]	Rejected. Arctic sea ice displays a convincing continuing decline in total area over recent decades. The figure, however, is removed in the SOD
7686	205	0	205	0	The figure is not clear. The box- and whisker and maps have no unit for the Yaxis. [isabelle gouirand, Barbados]	Accepted. The legend is a placeholder for a figure that illustrates the size of model biases in the SOD. Biases are explained in the revised caption
29874	205	0	205	0	Very low resolution [Mustafa Tufan Turp, Turkey]	Editorial
42454	205		205		The legend of figure 10.5 is wrong [Rita M Cardoso, Portugal]	Accepted. The legend is a placeholder for a figure that illustrates the size of model biases in the SOD. Biases are explained in the revised caption
41372	205				Fig 10.5 The legend should explain clearly what is meant by ‘bias’ and why this is important. [Debra Roberts, South Africa]	Accepted. The legend is a placeholder for a figure that illustrates the size of model biases in the SOD. Biases are explained in the revised caption
36664	206	1	206	1	In the figure, consider adding contextual highlighting (e.g., '-' boxes shaded light red, '+' boxes shaded light blue) or a summary row at the bottom to make it easier for the reader to quickly see the comparative strengths and weaknesses of the different methods. Scanning the table to try and tally up how many pluses and minuses there are is difficult. [Seth McGinnis, United States of America]	taken into account – has been revised and included as table. Color will be considered for final version
30282	206		206		Figure 10.6 should be checked in terms of some notations [Nazan An, Turkey]	taken into account – has been revised and included as table
29876	207	0	207	0	Figures are too small [Mustafa Tufan Turp, Turkey]	This figure is a placeholder. Has been replaced for SOD.
30284	207		215		The figures' resolution is very low [Nazan An, Turkey]	This figure is a placeholder. Has been replaced for SOD.
29878	208	0	208	0	Figures are too small [Mustafa Tufan Turp, Turkey]	Not applicable – figure has been removed.
29620	211	2	211	2	What does stippling mean in Figure 10.11? [Rodrigo Manzanas, Spain]	Not applicable – figure has been redrawn.
51068	213	6	213	7	Hibino and Takayabu reference is not in reference list [Bart Van den Hurk, Netherlands]	Accepted. The reference is included in the SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
30286	217		220		The figures' resolution is very low [Nazan An, Turkey]	Taken into account: all figures have been redrawn with substantial changes and final resolution will be high
57954	220	1	220	1	Lines could be made thicker and/or coloured. Will reference be added to the list at the end of the chapter? [Bas de Boer, Netherlands]	Taken into account: all figures have been redrawn with substantial changes and final resolution will be high
30288	222		233		Most of the figures' resolution is very low [Nazan An, Turkey]	Taken into account. Figure is placeholder. Resolution of final figure will be high.
51102	225	4	225	5	"black carbon" is mentioned in this figure. I guess "black carbon deposition" is meant [Bart Van den Hurk, Netherlands]	Taken into account: the figure has been redrawn for the SOD
26982	226	6	226	13	The third important question is missing: why are the positions of the North Atlantic jet different in CMIP3 and CMIP5? This should be explained, else the reader may be left with intransparent, vague and unclear information. [Joachim Rock, Germany]	Not applicable. Figure has been changed.
29880	228	0	228	0	Figure is too small [Mustafa Tufan Turp, Turkey]	
51216	229	1	38	1	The fact that the observations are shown as separate bars and the climatology as a continuous curve increases the amount of "white space" that points at the precipitation anomaly. This is somewhat suggestive in this figure [Bart Van den Hurk, Netherlands]	Noted. It is not clear if a revision is requested. However, the figure has been redrawn
51218	230	4	33	10	Maybe Atlas could show additional information on this Capetown drought event, for instance by showing spatial information linked to the catchment providing water to Capetown [Bart Van den Hurk, Netherlands]	Noted. We have interacted with the Atlas as part of the cross-chapter harmonization effort.
13864	10-42	31	42	31	joint to NorthAmerica, in Mexico by the REA methodolgy to be determinate the realibility for some zone of country (Andrade-Velazquez and Montero-Martinez, 2019: “CMIP5 Models reliability for the Usumacinta basin driven by the REA Method. Vol. 12. num 1.”). [Mercedes Andrade, Mexico]	Not applicable: text moved to the atlas (and reference suggested to the Atlas)
28486	10-54	41			A future projection of Caribbean low-level jet using AGCM with 20-km grid spacing has been published: T. Nakaegawa A. Kitoh, Y. Ishizaki, S. Kusunoki, H. Murakami, 2013: Caribbean low-level jets and accompanying moisture fluxes in a global warming climate projected with CMIP3 multi-model ensemble and fine-mesh atmospheric general circulation models, International Journal of Climatology, DOI:10.1002/joc.3733 [Tosiyuki Nakaegawa, Japan]	rejected – not relevant, performance is discussed, not projections.
28414	10-101	27			Future climate projections with spatially resolving of Caribbean small islands are provided in T. Nakaegawa, A. Kitoh, S. Kusunoki, H. Murakami, O. Arakawa. 2014. Hydroclimate changes over Central America and the Caribbean in a global warming climate projected with 20-km and 60-km mesh MRI atmospheric general circulation models, Papers in Meteorology and Geophysics, 65, p15-33, DOI: 10.2467/mripapers.65.15. [Tosiyuki Nakaegawa, Japan]	Not applicable: Text has been removed. Thank you for your suggestion. However, future climate projections are no longer included for the regional case studies (10.4) of the SOD revision to Chapter 10.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
41356	entire chapt				A table of all the various observational products would be very informative, global and regional, their characteristics, how they were derived, their time ranges, resolutions, strengths and weaknesses. Followed by a schematic showing how these raw inputs have been used to produce various derived products, with their characteristics, etc. Even the kind of output information obtained (e.g. mean monthly maximum temperature, or daily mean temperature, or annual temperature anomalies from pre-industrial). Is something like that possible? This would be a useful go-to table/figure for a reader, to give a clear overview. If one reads about a certain model run, one could then go look on the table what that means and how it compares to others. It could also help explain how different things relate to each other, for instance, how the SSP pathways have been combined with other models like CMIP, that could be shown in the schematic too. (This is a non-modeller commenting – someone who only has a most rudimentary understanding of the many modelling experiments, but needs to get a better overview in order to understand the implications down the line.) [Debra Roberts, South Africa]	Noted. An exhaustive table on observational products used for the WG1 assessment is found in Annex I. Exhaustive information on models used for the WG1 assessment is found in Annex III. Information on how models and scenarios have been combined (and about intercomparison projects) is given in Chapter 4: 4.2 Methodology.
41366	entire chapt				To summarize this chapter: “It’s complicated.” Climatologists are trying their very best. Methods are improving, but some problems are unsolvable (e.g. data existing gaps will remain). Other issues, like time or space resolution, coupling of models and subroutines, increasing integration of members in ensembles, etc will become easier to address with increasing computing power in the years to come. A non-specialist reader, interested in a particular region, wants to understand in general terms, what the different climate models involve, (what subroutines there are and what they do), what kind of information can be gotten from each, what some of the shortcomings are and the implications for conclusions that will be made re risks, impacts and adaptation, and what kind of information is solid and reliable. [Debra Roberts, South Africa]	Noted. Not clear if any revision is required or if the reviewer only wants to summarize the chapter.
41368	entire chapt				It is strongly recommended to reduce acronyms, only to keep those that are used frequently throughout report or at least throughout chapter. This improves readability. [Debra Roberts, South Africa]	Accepted. For the SOD we have used less acronyms and we have also introduced the ones we do use in the chapter and sometimes even at beginning of sections of the chapter.
21354		6		8	"...This result is consistent with the results for Brussels (Hamdi et al., 2015), but different from those for Beijing"… How? Why? Again, comparing Asian and EU cities, concidering all differences (population, structure, ….) is not the best solution [Gwenaelle GREMION, Canada]	Taken into account. Text modified for the SOD
42766					add reference as an example of internal climate variability study Pontoppidan,M., Kolstad E.W., Sobolowski, S. P., Liu, C., & Rasmussen, R. (2019)Largescale model biases in the extratropical North Atlantic storm track and impacts on downstream precipitation. In revision in Quarterly Journal of the Royal Meteorological Society [Rita M Cardoso, Portugal]	Taken into account: this reference has been added and discussed in the sub-section where we assess the added value of downscaling.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
48400					I would like to congratulate the Chapter 10 for this very comprehensive draft. There has been a significant improvement from the internal draft to the current version. Overall, the draft is well written and easy to understand. However, the structure of some sections could be improved in order to have a consistency through the chapter and to get rid of unnecessary long text. In addition, wherever possible, it would be better to have the section number while referring to other Chapters. Please bare in mind that these chapters have more than 100pages as well, pointing to a specific section, instead of a Chapter would make it easy to check the referenced text. [Rondrotiana Barimalala, South Africa]	Taken into account. For the SOD we have worked on consistency through the chapter and have shorted text. Instead of referring to other Chapters only with Chapter number, we have referred to the specific section of each Chapter where the information referred to can be found.
57138					cross chapter box 10.1 figure 2: this schematic can be more engaging. Contact TSU graphics officer (who created another version of this schematic) for more guidance/support. [WGI TSU, France]	Accepted. For the SOD this figure has been redrawn with help from the TSU graphics officer.
57140					Figure 10.3 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Rejected. This schematics was displayed at LAM3 as one good example of a schematic (according to the person that attended to the figure session).
57142					Figure 10.4 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. // RCM should be spelled out in the caption [WGI TSU, France]	Not applicable. Figure has been removed.
57144					Figure 10.5: GCM and RCM should be spelled out in the caption // units and axis title are missing// color bar is not ideal, please refer to IPCC visual style guide p.8-11 or contact TSU graphics officer for more guidance. [WGI TSU, France]	Accepted. The mentioned changes has been made.
57146					Figure 10.13: the rainbow colors are not suitable to properly visualize the date. Ideally, the precipitation palette from the IPCC visual style guide should be used with the central value being 1 (brown for ≤1 and blue for ≥1) [WGI TSU, France]	Not applicable. This figure has been removed for the SOD.
57148					Figure 10.14: a legend explaining colors/shadings/lines should be added to the figure // is there a reason why 2018-2028 2048-2058 and 2078-2088 periods are shaded in grey? // it is much more straightforward to have 2018/2028/2038 etc… as labels for the x axis. [WGI TSU, France]	Not applicable. This figure has been removed for the SOD.
57150					Figure 10.14: PR and SAT should be spelled out in the caption at least // "period of interest for attribution" could be annotated in the first panel (top left) // the globe could be more transparent to increase the visibility of green/blue rectangles [WGI TSU, France]	Not applicable. This figure has been removed for the SOD.
57152					Figure 10.16 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. (their should be a similar design concept with 10.17 and 10.18) [WGI TSU, France]	Not applicable. Figure has been changed for SOD.
57154					Figure 10.17 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. (their should be a similar design concept with 10.16 and 10.18) [WGI TSU, France]	Not applicable. Figure has been changed for SOD.
57156					Figure 10.18: this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. (their should be a similar design concept with 10.16 and 10.17) [WGI TSU, France]	Not applicable. Figure has been changed for SOD.
57158					Figure 10.19 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Not applicable. Figure has been changed for SOD.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
57160					Figure 10.20 : figures should be a bit more independent from the caption => Title and legend can be added to the figure to enhance the understanding at first glance // SAT and SLP to be spelled out // color palette is not quite sequential and does not render the data visually well, please check IPCC visual style guide or contact TSU graphics officer for more guidance [WGI TSU, France]	Not applicable. Figure has been changed for SOD. However the guidance on captions, the spelling out of acronyms and IPCC color palette has been used for all figures and captions in the SOD.
57162					Figure 10.22 : this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Not applicable. Figure has been changed for SOD.
57164					Figure 10.24: this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Not applicable. Figure has been changed for SOD.
57166					Figure 10.26: this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Accepted. This schematics on storylines has been completely redesigned with help from two CAs and in coordination with Chapter 1.
57168					Figure 10.27: this schematic can be more engaging. Contact TSU graphics officer for more guidance/support. [WGI TSU, France]	Not applicable. Figure has been removed for SOD.
57170					FAQ 1 figure: the figure is in line with what a general audience need (=no technical information), but the design concept should be revised [WGI TSU, France]	Accepted. New figure has been co-produced with TSU.
6235					This report is on the Linking of global to regional climate change, but is lack of any information on West Asia and just very rare on Central Asia. The report is weak in this regards. [Mostafa Jafari, Iran]	Noted. The chapter 10 is about methodologies that can be used when "Linking global to regional climate change". It is out of scope for chapter 10 to treat all regions, the chapter only use regions to show practical examples on the methodologies that are assessed in the chapter. Region-by-region assessments can be found in Chapter 12 and in the Atlas.
6237					Drought and flooding as two main climate change phenomena in arid and semi-arid region such as West Asia and Central Asia is totally neglected in the report. [Mostafa Jafari, Iran]	Noted. Drought and flooding in West Asia and Central Asia is treated in of Chapter 12, but is not in the scope of Chapter 10.
46694					Assessment on modes of variability occurs in Section 1.3.3; Section 2.4; Section 3.7; Section 4.4.3, 4.5.3; Section 6.2.2.5.1; Section 7.1.1/2 ; Section 8.3.1.3.2, 8.3.2.2, 8.3.2.4.1, 8.3.2.9.1, 8.4.2.5,8.5.2.2.1, 8.3.2.9.2, 8.4.2.5, 8.3.2.9.3, 8.4.2.5, 8.3.2.9.4, 8.4.2.5, Figure 8.43, 8.5.2.2.1, 8.5.2.2.1; Section 9.2.2.1, 9.2.2.3, Section 9.4.3.2, BOX 9.2, 9.2.3.1, Table 9.1, Section 9.2.1, Cross-Chapter Box 9.1, BOX 9.2, 9.6.2.1.1, 9.6.2.1.2, 9.5.4.7, 9.2.5; Section 10.1.4.2, 10.4.2.2, 10.6.3.3; Section 11.3.1, 11.7.1.1, 11.6.2, 11.1.5,11.4.1, 11.6.1, Table 11.4; Section 12.4.1, 12.4.4.3, 12.5.2.3; Section Atlas.5.2.1.2, Atlas.5.3.1.1, Atlas.5.3.2.1, Atlas.5.5.1.1, Atlas.5.5.2.1, Atlas.5.6.2.1, Atlas.5.6.3.1, Atlas.5.10.2.1, Atlas.5.10.2.2. This topic is addressed in ES of Chapter 2, 3, 4, 7, 11, addressed in box in chapter 9, and broadly addressed in above-mentioned subsections in chapter 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12. [WGI TSU, France]	Taken into account. Although the review requested is not explained we find this compilations useful to be able to refer back to for our sub-sub-sections 10.1.4.2, 10.4.2.2 and 10.6.3.3. Cross-chapter coordination around modes of variability have occurred since FOD submission.
39018					The reviewer had an impression that related discussions appear somewhat scattered, in 10.1.2.3, 10.1.3.1,10.1.3.2, 10.3.4.2, 10.5.2.1, 10.5.2.4, 10.5.3.1, etc. [Masahide Kimoto, Japan]	Taken into account. While the uncertainty concept is still discussed in these different sections, we have worked on the text in the sense to avoid overlap and assure consistency.

Comment ID	From Page	From Line	To Page	To Line	Comment	Response
46712					Moonsoon is assessed in section 3.3.3.2; Section 4.4.1.4, 4.5.1.5; 8.2.1.3, 8.3.1.3.2, 8.3.2.2, 8.3.2.4 , 8.4.2.3, 8.3.2.1.1 , 8.4.2.7, 8.5.1.1.2; Section 9.5.4.7; Section 10.4.2.2.1, 10.4.2.2.2, 10.4.3.2.1, 10.4.3.2.2, 10.6.3; Section 11.1.5, 11.4.1, 11.4.4, 11.4.5, 11.7.1, 11.9.5, 11.10.2, Cross-Chapter-box-11.1.1, Section 12.4.1.3, 12.4.2.3, 12.4.2.4, 12.4.2.6, Cross-chapter box 12.1; Atlas.2.2, Atlas.2.3, Atlas.5.2.2, Atlas.5.3.1, Atlas.5.3.1, Atlas.5.3.1, Atlas.5.3.2, Atlas.5.3.3, Atlas.5.3.3, Atlas.5.5.1, Atlas.5.5.2.2, Atlas.5.11.1.3, in the form of ES in chapter 3,4,8,11, box in chapter 8 and above-mentioned subsections [WGI TSU, France]	Taken into account. Although the review requested is not explained we found this compilations useful to be able to refer back to for our sub-sub-sections 10.4.2.2.1 and 10.4.2.2.2 (10.4.3.2.1 and 10.4.3.2.2 have been removed for the SOD).
48004					Executive Summary formatting is incorrect. Please bold the first sentence of each paragraph to highlight the main assessment conclusion, followed with additional details in unbold text. Please synthsise points further to have fewer key messages for policymakers. [WGI TSU, France]	Accepted. These changes have been made for the SOD.
43404					While this chapter addresses many climate impacts on people living within different regions, it fails to address the influx of human migrats and creation of climate refugrees in any region. Here is one such example linking climate change to crop yields and migration in mexico. Linkages among climate change, crop yields and Mexico–US cross-border migration Shuaizhang Feng, Alan B. Krueger, Michael Oppenheimer Proceedings of the National Academy of Sciences Aug 2010, 107 (32) 14257-14262; DOI: 10.1073/pnas.1002632107 Jayawardhan, Shweta. “Vulnerability and Climate Change Induced Human Displacement.” Consilience, no. 17, 2017, pp. 103–142. JSTOR, www.jstor.org/stable/26188784. [Saad Amer, United States of America]	Noted. The issue of human migration and climate refugees will be covered in the IPCC AR6 WG2 report, Chapter 8: Poverty, livelihoods and sustainable development. It is out of scope for the WG1 report which covers the "Physical Science Basis" for climate change.
43448					Suggestion to start regional climate sections with confidence evaluations of major phenomena, followed by explanations to allow for easier readability. Currently these sections are inconsistent, with some sections ending with confidence statements (eg 10.4.2.2.2 The East Asia summer monsoon weakening, 10.4.2.2.6 Western Europe summer warming), and others integrating them throughout regional discussions (eg 10.4.2.2.9 Asian cities warming). [Saad Amer, United States of America]	Taken into account. For the SOD, confidence statements have been located at the end of each sub-section of 4.2.