

Expert Review Comments on the IPCC WGI AR5 First Order Draft -- Chapter 14

Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14-1	14	0	0	0	0	I could not find a section that specifically discusses potential phenomena (ENSO, Monsson, ...) changes in the future using either CMIP3/CMIP5 scenario or other approaches - could this be a section between 14.2 and 14.3 ? [Eric Guilyardi, France]	Chapter is restructured and CMIP5 will form the baseline for assessing projections
14-2	14	0	0	0	0	I find the section 14.2 very descriptive and "review-like". It could be much shorter. [Eric Guilyardi, France]	Efforts made to move from review format to assessment format
14-3	14	0				Throughout the entire report there is general agreement that natural variability could dominate the anthropogenically forced response in the near-term and that in mid-latitudes the NAO/AO/NAM related variability is a key for understanding and quantifying this uncertainty. In my opinion an explicit figure on the expected changes (near and long term) in NAO/AO/NAM variability derived from the CMIP5 models used would be extremely helpful for the reader. The same could be argued for ENSO variability. Both figures could be placed either in chapter 9, 11 or 14. [Christof Appenzeller, Switzerland]	Accepted - CMIP5 figures for NAO/AO/NAM are now included in this chapter
14-4	14	0				Chapter 14 appears largely written by non native English speakers. Much of a revised chapter should be edited by an English speaking Review Editor before sending it out, though the current text is nearly all understandable to an expert. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	This will be improved
14-5	14	0				The important terms "state, pattern, mode, regime, teleconnection" must be used very carefully. The pages 14-3 to 14-5 define those expressions in a pure statistical way. The paper by Stephenson et al. (2004, Q.J.R. Met. Soc.) also includes important dynamical aspects. [Wanner Heinz, Switzerland]	Rejected - the physical dynamical interpretation is problematic and the readers are referred to recent papers such as Mohanan et al. 2009 that discuss this in detail.
14-6	14	0				The number of Figures in chapter 14 is very low. I recommend to include more references to the Atlas. [Wanner Heinz, Switzerland]	Efforts are made to increase the number of comprehensive figures. Likewise the Atlas will now be cross references throughout the regional sub-sections
14-7	14	0				Relying on teleconnection patterns to tell you about the regional/local effects of GHG-induced climate change is much like talking about explaining the impact on an ecosystem due to habitat destruction by talking only about the migration route of one species from that location. Maybe a poor analogy, but my point is that this chapter spends too much space talking about how secular changes in known teleconnection patterns (these changes mostly being fairly speculative) might affect climate over decadal to century scales in various regions. The main things in this chapter that seem not to be derived directly from teleconnection patterns are mention of poleward shifts in the termination of the Hadley Cell and of the subtropical jets (not independent of each other), plus general discussion of frequency and strength of tropical and extratropical cyclones. It seems that this weakness is due to a policy against using downscaled climate data. By having this policy, we are missing information on cases in which regional geographic features can modulate the response of climate to GHGs on a local to regional scale, independent of teleconnection patterns. Such features can be mountain ranges, water bodies that are sub-grid relative to GCMs, significant areas of irrigated agriculture, or atmospheric features such as a frequent low-level jet. I wish I had more work to offer on the North American Great Lakes system to offer up, but other work that immediately comes to mind is related to work on the central North American "warming hole", associated with the low-level jet originating from the Gulf of Mexico. Pan, Z., M. Segal, X. Li, and B. Zib, 2009. Global climate change impact on the Midwestern US—a summer cooling trend. In Understanding Climate Change: Regional Climate Variability, Predictability, and Change in Midwestern USA, S. Pryor, ed., Indiana University Press, 21-30. Pan, Z., R. W. Arritt, E. S. Takle, W. J. Gutowski Jr., C. J. Anderson, and M. Segal, 2004. Altered hydrologic feedback in a warming climate introduces a "warming hole". Geophys. Res. Lett., 31, doi:10.1029/2004GL020528. Many more examples exist. [Brent Lofgren, USA]	The comment is well taken. The chapter has been approved at the scoping meeting. We are now trying to include down scaling, where this add information or strengthen (or weaken) assessment statements.
14-8	14	0				The major thrust of this chapter is to place substantially greater importance on the role of large-scale processes for regional climate change than in AR4. This appears compelling, given the large number of these processes, the often global relevance through teleconnections, and the often dramatic impacts that overwrite regional variability. In the course of reading this chapter, however, it becomes increasingly more apparent that this approach suffers several weaknesses: (i) even in the best cases, only two to three EOFs are retained, which together rarely explain more than half of total variability; (ii) GCM mostly fail to reproduce with any decent fidelity the strength, frequency, and location of most large-scale processes, the main reasons being	Agreed. We try to extract these points along with statements about more robust statements about changes in phenomena and on regional change in climate parameters. Chapter has been restructured.

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						insufficient horizontal or vertical resolution and low skill in modelling ocean processes, in particular SST; (iii) not well-understood regional impacts of interactions between different large-scale processes; and (iv) inconclusive projections of changes in large-scale processes. These deficiencies in current numerical modelling are exemplified by the mostly disappointingly low skill of seasonal regional forecasts. The potential shortcomings are spelled out several times in the chapter, and yet, section 14.2. extensively describes each large-scale process and in the vast majority of processes concludes that there is little skill in predicting the process. By the time the reader gets through 25 pages of bad news to section 14.3 there is little confidence left that we are currently capable of modelling regional climate change with useful skill. It may be too late at this stage and unfeasible to change the approach, but to me the discussion of the many large-scale processes seems better placed in a separate chapter, even though the two chapters would become very small. [Christian Reuten, Canada]	
14-9	14	0				The term "significant" is used repeatedly, sometimes preceded by the word "statistically". Without this clear qualification, the reader is often left to wonder if "statistical significance" is implied or if "significant" means rather vaguely "substantial". I suggest using the word "significant" only with the additional qualifier "statistically" if a result is indeed "statistically significant". In all other cases, if at all possible, a result should be quantified, or else a word like "substantial" be used. [Christian Reuten, Canada]	IPCC calibrated language will be used as far as possible. This will minimize or eliminate this type of wording
14-10	14	0				The quality of writing varies substantially between paragraphs, in particular in section 14.2. While it is understood that English is not the first language of many of the expert contributors to the report, some paragraphs contain substantial typos like missing periods at the end of a sentence and spelling and grammar errors that are picked up by spell and grammar checkers. Basic proofreading and correction of such sloppy writing by the authors is an expression of professionalism and respect for expert reviewers, editorial staff, and readers. [Christian Reuten, Canada]	proofreading will be central for SOD
14-11	14	0				This chapter analyses the climate phenomena that can be relevant for climate change at regional scale. The chapter is well structured and it is providing a good reference for several processes at regional scale. Some parts should be expanded considering further recent papers and results. [Paolo Michele Ruti, Italy]	Accepted
14-12	14	0				The material of the IPCC SREX (2012, chapter 3) is highly relevant to this chapter but is not currently referred to (both in terms of changes in climate phenomena and with respect to regional changes). The provided assessments should be presented in the context of the SREX assessments, highlighting some possible modifications. [Sonia Seneviratne, Switzerland]	SREX will be central to SOD
14-13	14	0				Content of the present chapter is sufficiently descriptive. Readily available bibliography has been sufficiently taken into account. No significant modifications are suggested to text or figures at this stage. [Dirk Thielen, Venezuela]	Accepted
14-14	14	0				We suggest that Chapter 14 takes on the responsibility to include a comprehensive assessment of RCM results from multi-model ensembles within Section 14.3. We believe this will strengthen and add value to the assessments given in this section, for those regions where such coordinated multi-model results are available. Please coordinate to ensure that the necessary background information on RCM models that you need is covered in Chapter 9. [Thomas Stocker/ WGI TSU, Switzerland]	New structure of the regional sub-sections will ensure meeting these comments
14-15	14	0				Section 14.2 currently lacks background information needed to understand the described changes in phenomena. For example, the descriptions of the phenomena and modes of variability which form the core of this chapter, should be complemented with a set of conceptual figures to inform the user. [Thomas Stocker/ WGI TSU, Switzerland]	The main efforts of this round of revisions will address the lack of such information. This will include a number of central figures enabling a more comprehensive description of the role and significance of most of these phenomena.
14-16	14	0				Section 14.3.14 should include coverage of the scientific discussion regarding the pattern of mean surface temperature trends in Antarctica (eg, Steig 2009 / O'Donnell 2010). This is treated to some extent in Ch05 from the paleo-perspective, but this discussion needs to be picked up again here. [Thomas Stocker/ WGI TSU, Switzerland]	Antarctica will be assessed in better coordination with other chapters.
14-17	14	0				Sections 14.3.2 (Arctic) and 14.3.14 (Antarctica) should avoid overlap with Ch04 regarding changes in the cryosphere (eg., sea ice, ice sheet, ice shelf changes). [Thomas Stocker/ WGI TSU, Switzerland]	Agreed. Coordination with these chapters is now incorporated.

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14-18	14	0				The chapter is extremely short on figures. It seems to us that fundamental figures for the Chapter 14 assessment have to be included in section 14.3 (see separate comment);. [Thomas Stocker/ WGI TSU, Switzerland]	Many more figures are now envisaged to appear in the chapter
14-19	14	0				Please ensure that regional changes presented in the WGI Atlas are closely linked to the assessment in Section 14.3 by cross-referencing to individual figures in the Atlas. This should be complemented by expanding the Chapter 14 assessment to consider also the RCM multi-model results (see earlier comment). [Thomas Stocker/ WGI TSU, Switzerland]	The Atlas will serve as a fundamental entry in all regional sub-sections in the SOD
14-20	14	0				Box 14.2 requires text that links to, and guides the reader through the tables. [Thomas Stocker/ WGI TSU, Switzerland]	Accepted
14-21	14	0				Table 14.1: Please consider a graphically more appealing way of highlighting uncertainty ranges in the results presented, rather than using different font sizes. At least, make sure that all numbers in the precipitation column are vertically aligned. [Thomas Stocker/ WGI TSU, Switzerland]	Noted. We will be be investigating a graphical way to portray this and also refer to the Atlas
14-22	14	0				Please avoid giving key assessment results based on single publications, e.g., temperature and sea level assessment provided for New Zealand (page 53, lines 48-51). [Thomas Stocker/ WGI TSU, Switzerland]	Noted. With reference to the New Zealand will refer to underlying literature.
14-23	14	0				Section 14.3: For all regions, ensure observations and projections of extremes are consistent with the assessment given in Tables 3.2 and 3.3 of SREX; where your assessment is revised or updated, a careful comprehensive reasoning is needed. [Thomas Stocker/ WGI TSU, Switzerland]	This is the main idea with the new structure for the regional sub-sections
14-24	14	0				USA region: 'Robust significant drought throughout the region' - we are wondering whether this statement/assessment is consistent with projections given in Annex I: Atlas and in Chapter 12. [Thomas Stocker/ WGI TSU, Switzerland]	Revised text will cross check and re-assess this - Alex to conder
14-25	14	0				South America: page 41 - "extreme droughts and floods have occurred more frequently in recent years in several regions of SA". This and other such statements need to be supported by multiple lines of evidence and backed up by published literature. Please carefully cross-check and explain any inconsistency with the recent SREX assessment. [Thomas Stocker/ WGI TSU, Switzerland]	accepted-We included texts to show consistence with SREX and also mentioning that they report low to medium confidence in precipitation trends for South America. We included also cross references with chapter 2.
14-26	14	1	1	1	1	I have the following general suggestions for this chapter: 1) With a few exeptions, this chapter largely lacks the cross reference to other chapters, especially chapters 2, 9, 10, 11 and 12. 2) I suggest to add summaries to the individual main section that summarize the assessment (including quantified measure of uncertainty and confidence) as a basis for the statements in the executive summary. The statements of the sections are not traceable at the moment and a reference to the section number is not sufficient. 3) Subsections have very different style with some using questions as title (like the NAO subsection), but the SAM section does not. I suggest to homogenize the writing style. [Judith Perlwitz, United States of America]	Cross referencing is now key. Assessment statements will now be summarised for each section. Traceability is key in the revisions made to produce SOD. Homogenization will be ensured in the rewrite. DS: Point 3) accepted - question titles have now been removed from the NAO subsection.
14-27	14	1	1	1		Climate Phenomena and their Relevance for Future Regional Climate Change [Medani Bhandari, Nepal]	Yes
14-28	14	1	1	107	1	There are some significant overlaps between chapters 11,12 and 14 and we will have to coordinate carefully in order to avoid inconsistencies between figures, numbers, nottation and conclusions. [Matthew Collins, United Kingdom]	Agreed. Will do
14-29	14	1	3	1	21	The text to open the chapter is useful, but for the reader looking for regional understanding, makes for a heavy start. For example, the last sentence of paragraph 1 is not the most accessible concept for the non-scientist. I would suggest an intro that starts with distinguishing between projected change at regional scales and changes in regional and large scale governing processes, and so set the expectations of the reader for the process focus that follows. [Bruce Hewitson, South Africa]	Suppose this actually relates to page 6 same line: The introduction will be entirely rewritten
14-30	14	1	12	1	12	I presume contributing author country affiliations will be added (as per other Chapters)? [Peter Burt, UK]	Yes, country affiliations for all CAs will be provided, if not in the SOD then definitely at the time of the Final Draft.
14-31	14	1	29	1	29	14.1.2 should be correted to14.1.1(Qiyong Liu, China CDC) [Qiyong Liu, China]	Agreed

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14-32	14	1	34	1	34	14.2.2 should be corrected to 14.2.1 (Qiyong Liu, China CDC) [Qiyong Liu, China]	Agreed
14-33	14	1		93		I have unfortunately not had time for detailed comments, but hope these few help. Overall the chapter promises to be very useful ... I like the direction taken. The breakdown between 14.2 and 14.3 does present a challenge in structure, in that the two are intimately coupled ... perhaps cross-linking references between the two sections could help? Overall there are more placeholders than I would have anticipated, especially from my perspective, for Africa. There are a number of awkward grammatical constructions, but I imagine these will be resolved in due course. [Bruce Hewitson, South Africa]	Acknowledged. Will work towards improving on all these aspects
14-34	14	1		93		Basically sound presentation throughout, except for two factors I believe are important to this report; 1 - I consider that the omission of Tectonic Technology has a valid bearing. Islanders claim for Ocean Rise is the base reason... It is not the ocean that is rising, it is the fact that their Island is falling below the waves, because of tectonic plate movement that the Islanders are living on is slowly falling below the waves, secondly The Sun's Influence by the fact that our Earth is oscillating within the positive Heliosphere between the Sun's poles, is the base reason why we are experiencing the changed climate and that this situation began on the 15 February 2001 and will conclude on the 22 December 2012 which is also the final stages of these cyclic events which also concludes the 25,800 year Precession cycle..(6) [Thomas Watson, Australia]	Disagree. This chapter is not about sea level. The role of the Sun is treated in other chapters
14-35	14	1		93		Editor; My book: Climate Change Explained by Magnetism? ISBN9780646477220 (2009) May be bought from me at \$60.00AU or a CD (pdf) at \$30.00AU plus postage. I have proven my statements and can show why it is that our climate has changed, because of the Earth's orbital position within the Sun's Heliosphere has also influenced and changed the barometric pressures within our globe and it is this that has initiated and basically changed its climate with the current changes to our seasons. My Power Point CD; Is Carbon Dioxide the cause for Climate Change? is also available and will enclose it with any sale to the IPCC, or as a private sale.. [Thomas Watson, Australia]	Rejected. This is not a review comment
14-36	14	1		93		These general comments of the writers of this Chapter 14 are biased to the extent that they have presented a narrow understanding of their avenue of thought. Climate has always been a natural event and there are accurate records showing that this is so in many Journals and sites within the science realms, also in Australia. My book; Climate Change Explained by Magnetism? is a sound reference to acknowledge a new concept of understanding magnetism that identifies the reason why and how climate is controlled by our Sun's radiant magnetic activity and shows how this is happening, naturally. [Thomas Watson, Australia]	Rejected. This is not a review comment
14-37	14	1		93		I had to prove to myself that the emissions from Earth and how science associates Gravity and to understand this activity was found to be the actual ratio between the Electron to its Nucleus and my book illustrates this with a mathematical and diagrammatic answer to all the 103 natural elements known to science, is illustrated in Section 6. [Thomas Watson, Australia]	Rejected. This is not a review comment
14-38	14	1		93		My research shows that there is no influence to "Anthropogenic": human influence because I show the application of emitting Carbon Dioxide into the atmosphere, for I have seen and researched this topic and this gas DOES NOT RISE above where it is being generated. Its Atomic Weight is 44 and cannot possibly rise above other elements, lighter than Carbon Dioxide's atomic weight. This is nature's way of determining the Synthesis process and exchanges plant growth from this gas and expels Oxygen into the atmosphere.. [Thomas Watson, Australia]	Rejected. These issues are addressed in other chapters of this report
14-39	14	1		93		My research shows that there is no influence to "Anthropogenic": human influence because the application of emitting Carbon Dioxide into the atmosphere is a natural cycle that has been generated by our Sun's Cosmic Rays that collide into Nitrogen elements that go on to collide with Carbon Elements that turns them into Carbon 14 and they go on to collect two Oxygen elements that then turns them into Carbon Dioxide. This process is cycling during the Sun's presence to the atmosphere and is continually updating this cycle, daily. This cycle supports your IPCC presentation of the rising Carbon Dioxide "saw tooth" pattern. I have seen and researched this topic and this gas DOES NOT RISE above where it is being generated from. In Australia each person generates 0.000871% of Carbon Dioxide [and each breath out disappates within 10mille-seconds into the atmosphere] and with a population of 22.6 million, this may change our Earth's temperature by 0.054% in the next twenty odd years, so you see, for the IPCC to say that humans are responsible for this climate change is totally, untruthful to the world, Finally the oceans of the Pacific and the Arlantic and in our case here	Rejected. These issues are addressed in other chapters of this report

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						in Australia, the records show a steady rise over the last 150 years of 3.4mm per year, and in 2050, this represents 136mm (estimated), which to my understanding of ocean levels, is nothing to be ashamed of.. NOT meters as presented by Mr Al Gore's film, also his presentation of showing that "Hockey Stick" system knowing fully well that there is omissions of three other natural cycles, (dating back to 1350BC) where the worlds temperatures were well above the current cycle we are current cycle. My book shows this in detail... [Thomas Watson, Australia]	
14-40	14	3	1	3	49	Role of aerosols on regional climate needs to be considered. [S K Satheesh, India]	This is now added to the monsoon sections specifically
14-41	14	3	1	7	1	It perhaps goes without saying, and it will certainly be a challenge, but the executive summary should include more quantitative information about the magnitude of trends rather than just stating their direction. [Matthew Collins, United Kingdom]	The summary will be entirely rewritten
14-42	14	3	1	8	22	This is a very weird Chapter. It deals with an extremely diverse selection of "phenomena". It contains no actual observations or other information about local climate but is obsessed with sheer speculation about the future; exclusively fuelled by an obsession with absurd climate models and evidently uninfluenced by what is happening now [VINCENT GRAY, NEW ZEALAND]	We agree that the chapter deals with a diverse selection of phenomena. This is stated in the title. We disagree on, that observed and other information about regional climate is not presented. In the revised version this is even more clear as more direct links with other chapters are spelled out. Statements about future changes have considered how the understanding of present observed changes gives a solid foundation to assessing the robustness of future projections.
14-43	14	3	9	3	9	end of sentence, a word is missing, like knowledge, or studies, or data? [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-44	14	3	9	3	9	recent climate change => observed recent climate change [Matthias Zahn, United Kingdom]	Entire section rewritten
14-45	14	3	11	3	12	see first general comments: what about for the role of regional modelling? [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-46	14	3	12	3	12	Skip: some [Matthias Zahn, United Kingdom]	Entire section rewritten
14-47	14	3	14	3	16	Do you mean that there are uncertainties because of internal variability? Not clear. [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-48	14	3	14	3	16	Re "many aspects of regional climate change will remain uncertain as not all aspects of natural variability can be directly accounted for by a well-understood phenomenon as they are depicted in this chapter"; I expect that by "accounted for" the authors mean "modeled". There are other ways of understanding the forcing of natural variability, such as inference from paleoclimate studies. Natural variability is perhaps better understood than this statement implies. [David Sauchyn, Canada]	Entire section rewritten
14-49	14	3	19	3	20	By "Research on the co-ordinated multi model downscaling studies" do the authors mean use of regional climate models? [David Sauchyn, Canada]	Entire section rewritten
14-50	14	3	38	3	49	This paragraph summarizes the content of chapters 2, 11 and 12. What does the current chapter add; what is it's purpose? [David Sauchyn, Canada]	Entire section rewritten
14-51	14	3	51	5	17	The naming of climate phenomena here is not consistent with other chapters (see Table 1, Box 2.4 in chapter 2). For example, what is the Tropical Pacific Mode (page 14-4, lines 26-32)? IS ENSO, PDO, IPO? [David Sauchyn, Canada]	Agree. This will be corrected
14-52	14	3	53	3	54	"likely to strengthen" may be changed to "likely to increase" [Madhavan Nair RAJEEVAN, India]	Entire section rewritten
14-53	14	3	54	6	9	Just to note, I really liked the flagging of the section numbers against the bullet points: it made the material much easier to follow/read. I would commend this as good practice. [Peter Burt, UK]	Acknowledged.
14-54	14	3	54	62	34	There is inconsistency with the convention used for 20th or 21st Century: 20th, 20th, century, Century,	Entire section rewritten

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						twentieth, Twentieth,. Chapter 1, and the other Chapters which I have looked at, generally use 20th Century or 21st Century. I suggest the terminology in this Chapter is standardised to that form (number as a number, exponential 'th', 'st' and Century with a capital 'C'). I have not flagged all these instances in the following comments. [Peter Burt, UK]	
14-55	14	3	57			I suggest to specify the region or regions covered by the sake of uniformity with the other paragraphs [Ibouraïma YABI, Benin]	Entire section rewritten
14-56	14	3		7		Use of term "regional": this chapter is dedicated to the analysis of regional aspects of climate change, including the effects of both large-scale and local climate phenomena from the outputs of observations and global general circulation models. However, sometimes within the text this approach mixes up with the concept and usage of regional modelling (that sometimes are also referred in the text). I suggest to better clarify the above distinction in the Introduction (and in the Executive summary) to distinguish the approach in this chapter from chapter 10 (?) that is fully dedicated to RCM. [ANNALISA CHERCHI, Italy]	This will be improved
14-57	14	3		93		Acronyms: some of them are expanded, but most of them are not (mainly in the Executive Summary). All of them should be clearly expanded, or an appendix should be dedicated to this. [ANNALISA CHERCHI, Italy]	Editorial
14-58	14	4	4	4	4	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. The aerosols we are refering to here are anthropogenic in origin
14-59	14	4	5	14	5	Explicit ITCZ [Michel Petit, France]	Agreed
14-60	14	4	5	62	48	Compared to the others I have looked at, I found this a difficult Chapter to read. There is acronym overload and I struggled to keep track of things in places. Several acronyms are defined formally later in the text after they have been introduced, and there is inconsistent use of the acronym vs. the whole term. There are numerous typographical errors/inconsistencies in this Chapter, but I don't have space on the form to flag them all. Some of the key issues are: use of 'etc', this is imprecise and does not inform the reader of what they need to know; use of Nino/Niño and Nina/Niña; mismatches of singulars and plurals, missing definite and indefinite articles; American vs. British English. [Peter Burt, UK]	The chapter is largely rewritten to be more consstent and homogenous. The aim is to ease readability
14-61	14	4	6	14	6	Explicit SPCZ [Michel Petit, France]	Editorial
14-62	14	4	8	14	8	Explicit SACZ [Michel Petit, France]	Editorial
14-63	14	4	11			bring the punctuation before the parenthetical [Ibouraïma YABI, Benin]	Editorial
14-64	14	4	13	4	13	Why dipole modes? and what about for the others, like PNA, EA, etc? [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-65	14	4	14	4	14	Somewhere in this chapter a reference back to Chapter 2, Box 2.4 should be made to establish the sign convention for the modes discussed. I suggested that the positive phases of the modes be plotted in Fig. 2 of Box 2.4 for consistency, so that reference back to that figure could be done conveniently throughout all of the chapters to clearly establish the meaning of "positive" or "negative" phases of the various modes. [George Kiladis, USA]	Agree. This will be corrected
14-66	14	4	14	4	15	This statement is incorrect. Although a majority verdict to date, the evidence is not robust firstly because inclusion of a much more fully resolved model stratosphere gives a consistently different result over a range of new models. You reference, and later mention, the relevant paper: Scaife, A., et al., 2011: Climate change projections and stratosphere–troposphere interaction. Climate Dynamics, DOI18 10.1007/s00382-011-1080-7 but here its message is ignored. A second reason for doubt in the same direction is decreasing Arctic sea ice extent (and thickness). Evidence is increasing that this may lead to a heightened probability of a negative winter NAO. A problem here is that the details of the response of the winter NAO in models to this factor is not yet robust, but the effects could be quite large. This topic needs more discussion in Chapter 14 (related comment below on lines 51-2 of page 31). Such comments are about the winter NAO - summer NAO behaviour might differ. So "winter" needs adding here too. This is probably my most important comment. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Accepted - the statement has been rewritten more carefully avoiding the word "robust" and these new studies are now more fully discussed.

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14-67	14	4	14	4	15	I do not agree that the evidence from climate model projections that GHG increase leads to a small positive trend in the NAO is robust. The study by Morgenstern et al suggests that GHG increase leads to negative NAM in winter. (Morgenstern, O., et al. (2010), Anthropogenic forcing of the Northern Annular Mode in CCMVal-2 models, J. Geophys. Res., 115, D00M03, doi:10.1029/2009JD013347.) [Judith Perlwitz, United States of America]	Accepted - the statement has been rewritten more carefully avoiding the word "robust" and these new studies are now more fully discussed.
14-68	14	4	14	4	15	"14 • There is robust evidence from climate model projections that increased greenhouse gas emissions will lead to a small positive trend in NAO. (Section 14.2.9)". Carbon Dioxide (CO2) has an atomic weight of 44 and cannot possibly be applied to be used as an initial sequence to be applied to a statement like this. In Australia, the total CO2 population proportion to this molecule represents 0.000871% of the global influence, and this has a similar ratio for most European countries, such as Germany, with a ratio of 0.0005%. These are minute values as the CO2 introduction to the world's CO2 environment of 3.64% of our Atmosphere. It is also used to put out fires, known as "Dry Ice" [Thomas Watson, Australia]	Rejected. The comment does not relate to the content of the sentence
14-69	14	4	16	4	16	What is meant with "mean change in NAO"? eg, what is meant in mean change in a model of variability? [Elisa Manzini, Germany]	Accepted - This confusion about how modes of variability can project on changes in mean state has now been clarified in section 14.2.1.
14-70	14	4	22	4	23	A link/consistency check with corresponding section in Chap 9 is needed here [Eric Guilyardi, France]	Better cross chapter referencing is tried in the revisions
14-71	14	4	26	4	26	A "mode" is about variability where as this summary is mostly about mean state [Eric Guilyardi, France]	Entire section rewritten
14-72	14	4	26	4	32	The issue is approached in the wrong way, I think that a discussion of the ENSO flavors would be easier and clearer [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-73	14	4	26	4	32	The chapter mentions rather robust results on general shoaling of the thermocline in the tropical Pacific. This might bear mentioning in the executive summary [Brent Lofgren, USA]	This will be considered along the revisions
14-74	14	4	31	4	31	Link between the two (Walker circulation and SST E-W gradient and ENSO) is unclear or debatable. Uncertainty in the Walker circulation fate is, by far, not the only reason why nothing can be said about ENSO in the future (see Collins et al 2010 cited) [Eric Guilyardi, France]	Further discussions on this matter will be introduced if assessed relevant to the overall statements
14-75	14	4	34	4	34	Actually there are other modes in the IO, like IOB or EQUINO. So or the title is changed to Indian Ocean Dipole, or also the other modes have to be included. [ANNALISA CHERCHI, Italy]	Noted, but these modes may only play a small role and are assessed to have little relevance to the overall aspect of projected future climate change.
14-76	14	4	35	4	36	"35 • The sea surface temperature warming is likely to be locally reduced over the eastern equatorial Indian Ocean during July-November." This is happening because of the fact that our Earth is orbiting within the Positive Heliosphere and the Southern Hemisphere of Earth, is reacting as a Positive to Positive magnetic reaction and develops into a higher reactive factor allowing the Sun's rays to penetrate, giving this heat effect to land and oceans, and generates a higher barometric pressure, which in turn, generates the hot condition during this period. (6) [Thomas Watson, Australia]	Ignored. The assessed literature is in agreement with the current statement. The evidence as suggested by the comment is not substantiated by supporting literature.
14-77	14	4	38	4	38	"may" is too vague a statement - please use calibrated uncertainty language [Eric Guilyardi, France]	Agreed
14-78	14	4	43	4	44	what do you mean with "represents a reduction in spatial variations in climatology"? [ANNALISA CHERCHI, Italy]	Entire section rewritten
14-79	14	4	43	4	47	"43 • The observed SST warming in the tropical Atlantic represents a reduction in spatial variations in climatology: the warming is weaker north than south of the equator; and the equatorial cold tongue weakens both in the mean and interannual variability. The confidence of the projections over the tropical Atlantic - both for the mean and interannual modes - is low because of large errors in model simulations of current climate. (Section 14.2.7)" Totally agree. The effect here is the Sun's Positive Heliosphere reacting to the Northern Hemisphere and generating a reaction that gives our atmosphere a sense of warming during the July to November period.(6) [Thomas Watson, Australia]	Ignored. The statement is about projections not about current climate. Besides The evidence suggested by this comment is not supported by substantial literature
14-80	14	4	49	4	52	It may be worth specifying that the influence of ozone recovery is expected mainly during the first half of the 21	Aspects of ozone recovery will be more detailed

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
						century. [Alexey Karpechko, Finland]	
14-81	14	4	50	4	52	50 • The observed trend toward a positive SAM phase is likely to continue in projections of 21st Century 51 under further increases in greenhouse gases, but is likely to be counteracted by the recovery of 52 stratospheric ozone, especially in southern summer. (Section 14.2.10) This will continue to at least 2015 for our Earth will be feeling the influence of the Negative Sun's Heliosphere, and a change to our weather patterns will commence, once again..(6) [Thomas Watson, Australia]	Ignored. The statement is about projections not about current climate. Besides The evidence suggested by this comment is not supported by substantial literature
14-82	14	4	54	4	54	Titke should be "Tropical cyclones" [ANNALISA CHERCHI, Italy]	Accepted. Change made.
14-83	14	5	1	5	2	It would be good to mention here the possible confounding influence of natural variability of tropical cyclone activity at the regional level. That is, even if we were confident in the fidelity of reported trends as they exist in the data, we would still need to confront the issue of whether the trends were unusual compared with expected levels of natural variability or not. [Thomas Knutson, U.S.A.]	Accepted. Text has been added and modified.
14-84	14	5	1	5	2	The Executive Summary states that "there is low confidence in the fidelity of any reported regional trends in tropical cyclone activity on multidecadal timescales or longer". This statement needs to be modified to make allowance for a new study that is not discussed in the FOD of Ch 14 (Callaghan and Power, Climate Dynamics, 2011). In this study a downward trend in the number of severe tropical cyclones making landfall over north-eastern Australia since the late 19th century is identified. The trend is shown to be statistically significant at the 90% level. The authors conclude that the data are robust and suitable for trend analysis. This is based on their findings that e.g.: (i) the record exhibits a Poisson distribution (consistent with shorter satellite records of TC frequency); (ii) the variance in the first part of the record is the same as variance in the second part of the record; (ii) there is an ENSO imprint on the variability consistent with shorter satellite-based records; and (iv) the trend coincides with a trend in the SOI over the same period, and is therefore plausible. (continued in next row) [Scott Power, Australia]	Accepted in part. We will address this point in greater depth in Box 14.3, but feel that the suggested text is too specific for an executive summary. We changed the wording to better reflect that the confidence reflects detectability of trends, which requires quantification of internal variability, as opposed to simply reporting observed trends.
14-85	14	5	1	5	2	continued from previous row: (v) in the unlikely event that tropical cyclones were in fact missed these would have occurred in the early part of the record and so their inclusion would therefore increase the magnitude of the downward trend. Given the reliability of the data, the statistical significance of the trend and the fact that the dataset provides the longest available record of tropical cyclone/hurricane activity in the Southern Hemisphere and one of the longest in the world, I think this warrants a modification of the statement made in the Executive Summary (and elsewhere) to e.g. : "With the exception of a downward trend in the number of severe tropical cyclones making landfall over north-eastern Australia since the late 19th century, there is low confidence in the fidelity of any reported regional trends in tropical cyclone activity on multidecadal timescales or longer". [Scott Power, Australia]	See response to comment 14-84
14-86	14	5	2			The low confidence is also true for the activity on shorter than multidecadal timescales. [KAZUYOSHI OOUCHI, JAPAN]	Agreed. The text has been modified.
14-87	14	5	6	5	8	"Still, based on high-resolution modeling studies, the frequency of (7) the most intense storms will more likely than not increase substantially in some basins under projected (8) 21st century warming. (Box 14.3)" This again shows the interest of the effects of Anthropogenic Humans CO2 emissions. I again submit that this is due to the reactive influence of our Earth's Barometric pressures being influenced by the Sun's Heliosphere conditions being transmitted to Earth, during these changed conditions. [Thomas Watson, Australia]	Rejected. There is no literature admissible to this process that can be properly assessed to support this.
14-88	14	5	7	5	7	" more likely than not increase" is somewhat confusing. Can we slightly modify this? [Madhavan Nair RAJEEVAN, India]	We agree that this may sound a bit awkward, but it is a result of using the appropriate IPCC terminology, and we feel that it does convey the message correctly. We feel that the best choice is to leave it as

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							is.
14-89	14	5	13	5	14	"It is likely that the storm track in the southern hemisphere will 14 shift poleward in response to further anthropogenic forcing." Once again I believe that this is totally controlled by the fact that Earth is orbiting within the Sun's Positive heliosphere and that anthropogenic CO2 has little to no influence in this statement. [Thomas Watson, Australia]	Ignored. This comment is not backed up by a scientific reference
14-90	14	5	14	5	14	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	The word anthropogenic is used where there is a direct linkage to other chapters or when the projections is specifically seen as a result of the antropogenic emissions used to force a model.
14-91	14	5	19	5	19	remove "regional", and includes "regions" at the end of the title [ANNALISA CHERCHI, Italy]	Rewording is considered
14-92	14	5	19	5	19	The regional specific climate are continents (with the exception of the Arctic). Although clearly this is related to "impacts on society", form the physical point of view, also regions over the oceans are important: eg, the North Atlantic, with regard to the MOC and the Southern Oceans with regard to carbon uptake. Are the projected changes in these oceanic regions assessed in some other part of the report? [Elisa Manzini, Germany]	The main regions will be land areas. This is the intention with this chapter. Oceanic surfaces are expected to be considered in chapters 3, 11 and 12
14-93	14	5	19	6	9	This description of projected change inj regional specific climate lacks a description of the context. It is definitely not a comprehensive description of all climate changes in the regions identified as e.g. also climate change in N America will be characterized by an increase in temperature as well and not only by a loss of snowpack at high elevantions. The focus of that description seems to be those additional changes in climate due to the projected change in climate phenomena as described from page 14-3 line 53 to page 14-5, line 16. [Klaus Radunsky, Austria]	This will now be framed better
14-94	14	5	22	5	23	This statement on the Arctic addresses attribution but not projected change in the regional specific climate, related to temperature, precipitation and other paframeters used to describe climate. It is suggested to move the current language to chapter 10. It is noted that the current language of chapter 10 (see page 10-3, lines 53 to 54) use "likely" and not "very likely" as in chapter 14. [Klaus Radunsky, Austria]	Statements will now be on projections only. Cross chapter agreement will also be ensured
14-95	14	5	22	5	25	"The future evolution of temperature and sea ice in the Arctic on decadal time scales and longer will very 23 likely continue to be dominated by the signals of anthropogenic climate change. (Section 14.3.2) 24 25 North" Anthropogenic CO2 has no influence on this statement. The statement is basically correct, but for a different reason by the writers, because of the pressures that are being released by the Sun's Positive Heliosphere on Earth, causing the High Barometric pressures used to be pushed North in the Northern Hemisphere and South in the Southern Hemisphere. It is this effect that is bringing about the heavy rains to both hemispheres during their reversal seasons, like in the Southern Hemisphere, Australia is experiencing heavy rain during the months of December to February. [Science should be looking at the switched Barometric conditions of our world instead of looking at the Anthropogenic CO2 effect.] (6) [Thomas Watson, Australia]	Ignored. This comment is not backed up by a scientific reference
14-96	14	5	23	5	23	after the word "change" add the following ", with increased warming and melting, respectively." [ANNALISA CHERCHI, Italy]	Agreed
14-97	14	5	23	5	23	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	The word anthropogenic is used where there is a direct linkage to other chapters or when the projections is specifically seen as a result of the antropogenic emissions used to force a model.
14-98	14	5	26			Writing North America instead of N America [Ibouraïma YABI, Benin]	Agreed
14-99	14	5	32	5	32	Explicit LLJ [Michel Petit, France]	Editorial, changed text provided by the author
14-100	14	5	36	5	36	remove "is" between "extremes" and "projected" [ANNALISA CHERCHI, Italy]	Editorial
14-101	14	5	37	5	37	The number of... [Matthias Zahn, United Kingdom]	Editorial

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14-102	14	5	41	5	41	It is likely that the intensity of precipitation in Northern Europe depend on the strength of the zonal flow => It is likely that the change of intensity of precipitation in Northern Europe depend on the change of strength of the zonal flow. [Matthias Zahn, United Kingdom]	Editorial
14-103	14	5	41	5	43	The above remarks will affect this statement about European climate. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Agreed. The text will reflect further changes in the regional sub-section
14-104	14	5	44	5	46	44 • The patterns of projected precipitation change in summer season are coincident in all of the current 45 climate model projections supporting with moderate to high confidence that a significant rainfall 46 decrease across the entire Mediterranean region is likely. (Section 14.3.6) I disagree with this statement. The rain fall will be constant and eventually decrease sometime later in 2015 when the Negative Sun's Heliosphere influence will apply, causing the summer Norther Hemisphere to experience natural High Barometric reactions during this break., initiating clouds to a higher altitude, lowering the effect of rain conditions. [Thomas Watson, Australia]	Ignored. This comment is not backed up by a scientific reference
14-105	14	5	49	5	50	"El Nino-like" is not proper: El Nino stands for a variability, if you intend increased temperature in the eastern Pacific as mean state, you should write it properly [ANNALISA CHERCHI, Italy]	Text modified and this expression removed.
14-106	14	6	0	6	0	The chapter covers small islands but nothing is provided in the Exec Summary. A major new 530 page peer-reviewed report (BoM-CSIRO 2011 (Full details: Australian Bureau of Meteorology and CSIRO, 2011: Climate Change in the Pacific: Scientific Assessment and New Research. Volume 1: Regional Overview. Volume 2: Country Reports)) has been released describing projected changes in and around 15 island countries by the PCCSP (see www.pacificclimatechangescience.org; Power et al. Bull. American Meteorol. Soc., 2011) and this can be used to provide a wealth of information on this topic. Strongly recommend that this section is greatly expanded using this report, associated papers and other material, given that e.g. some of the countries are highly vulnerable to climate change, not much information was provided last time, and a great deal of new information has become available since the last IPCC report. This could provide a major advance on what was provided in the last IPCC report. [Scott Power, Australia]	The small islands is an integral part of this chapter. The material will be assessed. Have now included a summary of much of the material in the PCCSP reports
14-107	14	6	2	6	4	2 • A drying trend is likely to continue over southern Australia through the 21st century, and is likely to 3 become evident over the north and east of New Zealand. Precipitation is likely to increase in the west of 4 New Zealand in winter and spring. (Section 14.3.12) I do not agree with this statement. Our winters will remain with a low rain condition. We experienced only drizzle conditions for the last six years, (since 2006) because as before stated, during July to September, the barometric pressures have been HIGH, up to 1041mb, and this is again reacting to the Sun's Magnetic Positive Heliosphere that is controlling our climate. [Thomas Watson, Australia]	Peer reviewed scientific literature supporting this statement is not available
14-108	14	6	7	6	7	insert "continent" after "Antarctic" [ANNALISA CHERCHI, Italy]	Sentence will be rewritten
14-109	14	6	7	6	9	"7 • Total sea ice extent in the Antarctic has been increasing slowly in recent decades, but the trend is likely 8 to reverse over coming decades, as continued warming comes to dominate the effects of increasing 9 westerly winds over the southern oceans. (Section 14.3.13) • Total sea ice extent in the Antarctic has been increasing slowly in recent decades, but the trend is likely" I disagree with this staement. The Antrartic ice sheet will continue t increas on avarage because our Earth has commenced to cool down as of the the year 1998 and the Oceans are showing signs now of cooling down since 2003. These facts can be substantiated by referring to up to date records taken from reliable University research centres such as the University of Colorado, USA showing actual recordings of high and low Ocean records up to 2008 of the Atlantic and Pacific Oceans. My research in Australia supports these figures. As mentioned before, our Earth is cooling, not warming as indicvated the aboaove statement. [Thomas Watson, Australia]	The assessment statement is about projections and not about present trends
14-110	14	6	8	6	9	do you mean that "warming" and "westerly winds" are competing processes? [ANNALISA CHERCHI, Italy]	The statement will be reworted and made more clear
14-111	14	7	1	34	1	I have to say that the organisation of the discussion about regional climate change around modes of variability and phenomena works really well. It is much more akin to the way that climate scientists think about regional climate change and hence the flow is very natural. Given that section 14.2 works so well, it seems a bit odd to then have a more traditional region-by-region section 14.3 which, for example, duplicates many of the citations. I wonder if it is possible to integrate the regional discussion in with the phenomena? [Matthew	A new structure to better handle possible overlaps and minimize repetitative statements is implemented for SOD

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						Collins, United Kingdom]	
14-112	14	7	3	7	8	This paragraph exemplifies an issue I take with the chosen terminology regarding spatial scales. 'Global' and 'large-scale' are applied with their obvious meanings. However, an atmospheric scientist working on phenomena on the scale of hundreds of meters to tens kilometers would not consider convergence zones, jets, and storm tracks as 'local' phenomena. These are clearly 'regional' phenomena. The interchangeable use of the terms 'local' and 'regional' becomes apparent in the last sentence of the first paragraph (lines 7-8). Because this chapter does not clearly define and delineate these two spatial scales it fails to acknowledge the role that local processes might play in regional climate projections. [Christian Reuten, Canada]	Acknowledged. We will introduce scales trying to encompass these comments
14-113	14	7	4	7	4	AR4 and previous reports contained a Table for Acronyms (Annex IV) which will hopefully be done for AR5. In this chapter there is one table for acronyms in Box 14.2 but this might be more useful if it were referenced towards the beginning of the chapter. In any event many of these terms were defined initially in Chapter 2, and others in various chapters following, so an effort to cross reference those will be necessary throughout. [George Kiladis, USA]	Noted
14-114	14	7	5	7	5	remove "regional" between "future" and "climate", and include "in specific regions" between the word "change" and "in" [ANNALISA CHERCHI, Italy]	The sentence will be rewritten
14-115	14	7	10	7	11	This is not a complete sentence [George Kiladis, USA]	Acknowledged. Will rework
14-116	14	7	10	7	11	This sentence seems to lack a predicate. [Adam Monahan, Canada]	Acknowledged. Will rework
14-117	14	7	17	7	20	This paragraph seems out of context for the Introduction and could be removed without loss of continuity [George Kiladis, USA]	Agreed
14-118	14	7	23	7	29	The term "regional" overused, some rewording necessary. [George Kiladis, USA]	Agreed
14-119	14	7	23	7	29	Needs to be completely revised to agree with the changed conditions as expressed above. [Thomas Watson, Australia]	Disagree, see previous comments by TW
14-120	14	7	26	7	28	It may be mentioned why this is not done [Matthias Zahn, United Kingdom]	Agreed. Will rework
14-121	14	7	26	7	29	I was rather suprised by the contents of this chapter, and I do not understand why there is such a shift compared to the 4AR. I symphasize with the idea of focussing on a process level understanding of regional changes, but I think there is far to much focus on dynamical processes, with an almost complete lack of the discussion of the thermodynamic processes. A considerable part of the changes in mean precipitation is due to the thermodynamics processes, also on more regional scales. This is even more the case for the extremes as shown e.g. by Emori, S. & Brown, S.J., 2005. Dynamic and thermodynamic changes in mean and extreme precipitation under changed climate. Geophysical Research Letters, 32(17), pp.1-5. [geert lenderink, The Netherlands]	The SOD will add more on thermodynamic processes in the regional sub-sections, but the focus will remain on dynamics.
14-122	14	7	28	7	29	I'm not sure I would agree with the singular statement that the reader should go to the atlas for "detailed spatial information on changes" ... I struggle find detailed spatial information there ... detailed data, yes. Information? Possibly. This is, of course, a fundamental limitation in the AR5 ... where does a reader go to find detailed spatial information, and there are many readers who will be looking for exactly that? I think this chapter can play an important role in directing readers to other additional sources ... possibly in downscaling assessment text to the degree they might appear elsewhere in WG1, or maybe a suggestion to go to part B of WG2? [Bruce Hewitson, South Africa]	The Atlas will serve as a fundamental entry in all regional sub-sections in the SOD. But it is a major role of this chapter to assess the maps provided therein
14-123	14	7	29	37	55	I struggled to find the Annex material. The text refers the reader to the Annex, but no figure numbers are given, so I had to hunt for what I thought was the correct information (although if I have assessed it correctly appears to be appropriate). Given we are supposed to be commenting on the annex material relative to the text, this is disappointing! [Peter Burt, UK]	Agreed. The Atlas was not available in a form that allowed detailed discussions (or any at all as it was likely that major changes would take place) at the time when the regional sections were drafted.
14-124	14	7	36	7	36	It's not clear what the "new way" is, the previous paragraph only cites what is not done here [George Kiladis, USA]	Agreed. The language will be changed

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14-125	14	7	37	7	37	The role of what? [George Kiladis, USA]	Editorial
14-126	14	7	41	7	42	Note that while some of the responses in the tropical Pacific have some commonality with El Nino, many do not (Collins et al., Nature Geoscience, 2010; Power and Kociuba, Climate Dynamics, 2011b). For example, during El Nino the Southern Oscillation Index (SOI) tends to decline, whereas 21st century projections exhibit a very robust increase (Power and Kociuba, Climate Dynamics 2011b). Other papers also recommend avoiding use of this analogy e.g., Vecchi et al., Guilyardi et al. Collins et al. 2010 Nature Geoscience. Rainfall teleconnection patterns associated with El Nino also exhibit many differences to projected changes and so the analogy can cause confusion (Collins et al., Nature Geoscience, 2010). So suggest either deleting: "weak shift towards average background conditions which may be described as 'El Nino-like' " or else put in a caveat along lines given in first sentence in this review comment. [Scott Power, Australia]	This part is summarizing AR4, not making new assessment statements.
14-127	14	7	41	7	44	41 Mean Tropical Pacific Climate Change: Multi-model averages show a weak shift towards average background conditions which may be described as 'El Niño-like', with sea surface temperatures in the 42 central and east equatorial Pacific warming more than those in the west, weakened tropical circulations and 44 an eastward shift in mean precipitation." As previously mentioned, sea temperatures are slowing falling down since 2003 and this trend will continue to around 2023 plus when the Earth will agains another change to its seasal change.. [Thomas Watson, Australia]	The comment is not supported by a rigorous scientific reference
14-128	14	7	42	7	42	change "which may be described as El Nino-like" with "corresponding to an El Nino state" [ANNALISA CHERCHI, Italy]	We are using the words of AR4
14-129	14	7	46	7	46	change the word "show" with "project" [ANNALISA CHERCHI, Italy]	We are using the words of AR4
14-130	14	7	46	7	48	which is the meaning of "continued variability"? I suggest to rewrite the two lines [ANNALISA CHERCHI, Italy]	We are using the words of AR4
14-131	14	7	53	7	53	insert "in" between "and" and "the southern" [ANNALISA CHERCHI, Italy]	editorial
14-132	14	7	54	7	54	change with "decrease in the Sahel during northern hemisphere summer" [ANNALISA CHERCHI, Italy]	We are using the words of AR4
14-133	14	7	54	7	55	"Australian monsoon in 55 southern summer in a warmer climate".While I agree in principle, the Australian continent during this of 2012 Summer period is cooler, not warmer on average, and there has been some heavy rain falling during this season, already in Geelong, Victoria, 79mm has been recorded at home between 1st December 2011 to 7/1/2012. This is equivalent to average 2mm per day during the first month of summer.. Just 75km away,Melbourne, with 100mm of rain plus large hail stones fell within 5 hours on 25 December 2012, [Thomas Watson, Australia]	The comment does not suggest a change and the information provided does not relate to the statement in general. Besides, the sentences comes from AR4.
14-134	14	7	55	7	55	insert "hemisphere" between "southern" and "summer" [ANNALISA CHERCHI, Italy]	editorial
14-135	14	7				The distinction between "local" and "large-scale" phenomena is not clear to me. For example, the eddy-driven jets are global in extent & driven by meridional eddy fluxes of momentum – so are "large-scale" in this sense – but of course the associated momentum budget is expressed in terms of local fields & derivatives, so they are "local" in this sense. It would be helpful if the distinction were better clarified. This distinction becomes further blurred in lines 43-46 on P. 8. [Adam Monahan, Canada]	An effort towards being more precise in the wording about scales is made for the SOD
14-136	14	8	1	8	1	In order to transition between chapters 11 and 12, I wonder if it would be a good idea to have a section before the main discussion of modes and phenomena which summarises the main 'thermodynamic' response of the system. i.e. the land-sea warming contrast, polar amplification (in the N. Hem), the poleward expenasion of the sub tropics etc. Just to let the reader kown that there are some basic/robust changes that are boring in comparison to the exciting discussion of modes and phenomena but are nevertheless, important. I realise these features are discussed but I wonder that, if they had their own section, there would be a better hand-over from ch 12. [Matthew Collins, United Kingdom]	Acknowledged. We will summarize certain aspects of thermodynamic responses in the introduction and elaborate further on this in a new bridging section between the modes and the regions.
14-137	14	8	4	8	11	There are also important changes in MSLP projected in association with a weakening of the Walker circulation. See e.g. Power and Kociuba Climate Dynamics 2011, Power and Kociuba J. Climate 2011. Here is corresponding text to consider for inclusion: "MSLP is also projected to increase over the maritime continent and decrease in the eastern equatorial Pacific, with both changes associated with a projected weakening of	This sectionis based on AR4.

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						the Walker circulation". [Scott Power, Australia]	
14-138	14	8	4	9	8	I am not sure if this is accurate. Some models, at least in summer in the Northern Hemisphere, decrease pressure at mean sea level widely over land and increase it over the oceans as a result of the extra transient warming over land by the end of the 21st century compared to the oceans. This factor should be assessed in Chapter 14, and incorporated into the conclusions. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Assuming that this comment only is concerned with the sea level pressure discussion, we are only referring AR4 here.
14-139	14	8	15	8	15	remove "notably, where analyzed," [ANNALISA CHERCHI, Italy]	AR4
14-140	14	8	15	8	16	change "Most recent published modelling studies investigating" with "In terms of" [ANNALISA CHERCHI, Italy]	AR4
14-141	14	8	16	8	16	after the word "frequency" insert ", the models" [ANNALISA CHERCHI, Italy]	AR4
14-142	14	8	17			Need to be more careful in stating "there is less confidence in these projections ..." as there should be spread in the confidence level. [KAZUYOSHI OOUCHI, JAPAN]	AR4
14-143	14	8	21	8	22	"The increased wind speeds result in more 22 extreme wave heights in those regions." These increased conditions are due to the changed Barometric pressure differences between the Lows and Highs and due to the fact that Earth has slipped into the summer season tilt within the Southern hemisphere. The dramatic differences associated to these conditions invariably develop strong differences in pressures that generate strong winds in summer. Like 7th. February 2009 with gusts of over 112Km per hour:1020mb High (a winter High) with five 978mb, centres, north and south of this High..(6) [Thomas Watson, Australia]	It is not clear how this relates to the draft text. The arguments provided are not supported by a scientific reference - rejected
14-144	14	8	22	8	22	"oceanic wave heights" [George Kiladis, USA]	AR4
14-145	14	8	25	9	20	Box 14.1 is very good but is also relevant to the complementary discussion about modes in Chapter 2 where such a background discussion is lacking. Lead authors should discuss with Chapter 2 where Box 14.1 really belongs. Wherever it goes, the other chapter should cross refer to it. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Accepted - discussions have taken place to ensure consistency between the two chapters and Chapter 2 now refers to Box 14.1 in Chapter 14.
14-146	14	8	25	9	20	The Cold-Ocean Warm-Land (COWL) pattern should be included here. It is a pattern with strong links to anthropogenic climate change. References include: Wallace, J. M., Zhang, Y. and Bajuk, L. 1996. Interpretation of interdecadal trends in Northern Hemispheric surface air temperature. J. Climate 9, 249–259. Corti, S., Molteni, F. and Palmer, T. N. 1999. Signature of recent climate change in frequencies of natural atmospheric circulation regimes. Nature 398, 799–802. Iversen, T., J. Kristiansen, T. Jung and J. Barkmeijer. (2008) Optimal Atmospheric Forcing Perturbations for the Cold Ocean Warm Land Pattern Tellus 60A, 528-546. DOI: 10.1111/j.1600-0870.2008.00310.x. [Trond Iversen, United Kingdom of Great Britain & Northern Ireland]	We agree that this phenomenon need attention. We do, hwoever treat it as part of other phenomena, e.g. the monsoon systems
14-147	14	8	27	9	18	Box 14.1 needs to be better organized, i.e. EOF and PC concepts should be included into the description of "climate patterns" and "climate index", respectively, or they can be described separately but before all the other concepts [ANNALISA CHERCHI, Italy]	Accepted - Box 14.1 has now being reorganised more logically.
14-148	14	8	27	9	18	Illustrates the old trick that if you do not understand something, cover up your ignorance by inventing a word to decrbe it. [VINCENT GRAY, NEW ZEALAND]	We are only using terminologies accepted in the literature
14-149	14	8	27	9	18	Box 14.1 is a very useful attempt to summarize patterns and indices. I think it would be more logically organized to define teleconnection and teleconnection pattern first, then Climate Pattern and Climate Index. Climate mode is defined essentially as a Climate Pattern here, so suggest rolling these definitions together. Climate Regime could be defined last, since it is not a necessariy defined as a pattern per se. [George Kiladis, USA]	Accepted - Box 14.1 has now being reorganised more logically.
14-150	14	8	31	9	22	Climate phenomena include a lot phenomena, here just lists several, how to explain others, such as drought, flood,etc.(Qiyong Liu, China CDC) [Qiyong Liu, China]	Noted. 'Impacts' such as floods follow from the effects of phenomena but are not a core part of this chapter. More in keeping with WG2.

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14-151	14	8	33			"... provides an aggregate summary of " an aspect of " the state of climate system" [Adam Monahan, Canada]	Rejected - "aspect of" is implicit in the act of summary.
14-152	14	8	34	8	34	insert "in specific regions" after "system" [ANNALISA CHERCHI, Italy]	The sentence is modified
14-153	14	8	37	8	40	Please give an example to help the reader understand / visualize a climate pattern. [Tsz-cheung Lee, Hong Kong]	Accepted - temperature and precipitation teleconnection patterns are now included in the summary figure for this Chapter.
14-154	14	8	38			Given the politically contentious nature of an IPCC report, it may not be wise to label a spatial structure as "b(s)" (read BS) [Adam Monahan, Canada]	Accepted - less scatalogical mathematical symbols are now employed.
14-155	14	8	39	8	40	insert "or linear correlation" after "regression". Further, why this recent reference here? [ANNALISA CHERCHI, Italy]	Accepted - the reference has now been moved to the general discussion about modes in 14.1.
14-156	14	8	43	8	43	I suggest expanding 'widely separated' to explicitly state 'widely separated, geographically fixed' locations for clarification --i.e. teleconnection patterns are stationary [David Gutzler, USA]	Accepted.
14-157	14	8	48	8	52	This definition equates "teleconnection pattern" with "climate pattern" although it appears that there is an effort to define the former by regression and the latter as a correlation. Either simplify the discussion by eliminating one or the other term, or stick to separate definitions for each. [George Kiladis, USA]	Accepted - this has now been explained more clearly.
14-158	14	8				Is "sea level pressure" a phenomenon like storms, or monsoons? [Adam Monahan, Canada]	In the present context, we have used information stated in AR4. We will consider to reword the heading as there was no 'phenomena' chapter in AR4.
14-159	14	9	1	9	2	remove from "The" to "x(t)", as it has been already written before [ANNALISA CHERCHI, Italy]	Accepted.
14-160	14	9	2	9	3	sentence in paranthese should be moved in "climate pattern" [ANNALISA CHERCHI, Italy]	Accepted.
14-161	14	9	3	9	4	sentence should be moved in "climate index" [ANNALISA CHERCHI, Italy]	Accepted.
14-162	14	9	23			Sect.14.2: The definition of "phenomena" required here (to interpret regional changes in sect.14.3) is either too narrow or needs to be replaced with a discussion of "processes". In particular, I think thought needs to be given to including other processes, currently missing, that are key to sect.14.3. Examples are (1) local thermodynamic tropical processes, such as the 'rich-get-richer' and 'upped ante' mechanisms of eg. Chou and Neelin (2004) and Chou et al. (2009), and (2) mid-latitude summer processes, such as spring soil moisture declines, summer soil moisture feedbacks, and changing land-sea temperature contrasts, eg. Rowell and Jones (2006), Rowell (2009), Seneviratne (2006) and others cited therein. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Accepted - The discussion of local ambient conditions in 14.2.1 now explicitly mentions such thermodynamic processes and cross-refers to Chapter 11 and 12 where they are discussed in more depth.
14-163	14	9	23			Citation details for comment #25: Chou, C., and J. D. Neelin, 2004: Mechanisms of global warming impacts on regional tropical precipitation. J. Climate, 17, 2688–2701. Chou, C, Neelin, DJ, Chen, C-A, Tu, J-Y, 2009: Evaluating the "Rich-Get-Richer" Mechanism in Tropical Precipitation Change under Global Warming. J. Climate, 22, 1982-2005. Rowell, D.P., 2009: Projected midlatitude continental summer drying: North America versus Europe. J. Climate, 22, 2813-2833. Rowell, D.P. and Jones, R.G., 2006: Causes and uncertainty of future summer drying over Europe. Climate Dynamics, 27, 281-299. Seneviratne, S.I.; Luethi D; Litschi M; et al. 2006. Land-atmosphere coupling and climate change in Europe Nature, 443, 205-209. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Noted
14-164	14	9	27	9	31	Wording! It is said that key processes are described, but point 1 and 3 refer to conditions. I do not think a condition is a process ! The term factors seems to be more appropriate. [Matthias Zahn, United Kingdom]	Accepted. Now reworded more carefully to describe processes and the conditions they lead to.
14-165	14	9	27	9	32	These are indeed three key processes that affect regional climate, but regional climate does not results from these key processes alone. Truly local processes on smaller scales have non-linear responses to larger-scale processes and environmental conditions, for example albedo feedback mechanisms in regions with winter snow cover, vertical heat transport processes in steep complex terrain, and moisture feedback mechanisms via soil moisture and vegetation. Furthermore, regardless of our depth of understanding of processes along all	Accepted. These examples of truly local processes are now mentioned under the first point. The word "interacting" has been added after "complex superposition" to help cover the point made about turbulence.

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						spatial scales, the cascading of stochastic processes like turbulence will remain a substantial source of noise, making it very difficult in some instances to extract a statistically significant signal. A very good example are tropical cyclones, and Box 14.3 lays open the issue very well. [Christian Reuten, Canada]	
14-166	14	9	27			Footnote: Why not all statistical properties? Including joint probability distributions --particularly important for climate phenomena-- , and temporal covariances. [Ramon de Elia, Canada]	Accepted. The footnote has now been revised to make this more general meaning clear.
14-167	14	9	28	9	28	What are regional systems ? I suppose neighbouring weather systems (or similar) are referred to. [Matthias Zahn, United Kingdom]	Accepted. This has now been reworded to make it clear that we are referring to local weather systems.
14-168	14	9	38	9	38	include "climate" between "wll-known" and "phenomena". Remove "that have strong impacts on regional climate" [ANNALISA CHERCHI, Italy]	Accepted.
14-169	14	9	45			I wouldn't say that future regional climate is uncertain "because each process is likely to change with climate change, and the processes can interact with one another" , since a good model might be able to capture these interactions. Interactions make it difficult to infer from simple rules. [Ramon de Elia, Canada]	Accepted. The word "because" has been removed.
14-170	14	9	47	9	47	Include "Therefore," before "regional" [ANNALISA CHERCHI, Italy]	Rejected. We don't agree that the list is a consequence of the previous sentence.
14-171	14	9	50	9	51	The use of the term "ambient" is also a bit confusing. What defines ambient? The example given makes it seem that "ambient" relates to vertically-varying but otherwise local processes, while "regimes" are associated with horizontally structured variability. [Adam Monahan, Canada]	Accepted. By ambient we mean the state of the climate system under constant forcing. It can vary spatially and temporally. This has now been made clear in the text.
14-172	14	9	50			The factors chosen as responsible for regional climate change seem to be dependent on each other. My impression is that this point adds more confusion than clarity and it could be removed without loss. [Ramon de Elia, Canada]	Rejected. We believe that this listing helps make it clear why regional climate change is so complex.
14-173	14	9	51	9	51	change "more" with "increased" [ANNALISA CHERCHI, Italy]	Accepted.
14-174	14	10	7	10	13	It would be useful, to report / asses what is common /justified practice in the evaluation of "changes in the modes of variability": Is it always meant with respect to a time evolving mean? [Elisa Manzini, Germany]	Accepted. It has now been made clear in 14.1 that various approaches are used to define modes - some define variations relative to local means whereas others used fixed references in the past.
14-175	14	10	15	10	16	" ... a climate mode still plays a very ..." should be " ... a climate mode may still play a very ..." [Adam Monahan, Canada]	Accepted.
14-176	14	10	21	10	22	sentence unclear: they have to better represented not to be misrepresented, what does that mean? [ANNALISA CHERCHI, Italy]	Accepted. Now reworded to avoid confusing repetition.
14-177	14	10	23	10	37	An exercise in concealing ignorance [VINCENT GRAY, NEW ZEALAND]	This section is reflecting published literature on the subject of describing variability using various mathematical formalisms. We do not think this is about ignoring important matters
14-178	14	10	34	10	37	Several observations and theoretical arguments seem to support the idea that winter planetary waves indicators obey a non-gaussian statistics and may present a multimodal probability density function, thus characterizing the low-frequency portion of the climate system. Other relevant papers support this result and provide estensions. Several observations and theoretical arguments seem to support the idea that winter planetary waves indicator obey a non-gaussian statistics and may present a multimodal probability density function, thus characterizing the low-frequency portion of the climate system. For instance the upper tropospheric jet strength is a critical parameter in determining whether the planetary waves indicator exhibits a uni- or bimodal behavior (PM Ruti, V. Lucarini, A. Dell'Aquila, S. Calmanti, A. Speranza, 2006 Does the subtropical jet catalyze the atmospheric regimes? Geophys. Res. Lett. Vol. 33, L06814 doi:10.1029/2005GL024620). While how climate forcing can influence the statistical distribution of regimes is well described in Corti et al (1999). Corti, S., Molteni F., Palmer, T.N. (1999) Signature of recent climate	Rejected. The linear paradigm does not rely on the strong assumption of Gaussianity e.g. the distributions of the indices can be unimodal and skewed. The extensive literature on multi-model paradigms are discussed in the cited references.

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						change in frequencies of natural atmospheric circulation regimes. Nature, 398, 799-802. [Paolo Michele Ruti, Italy]	
14-179	14	10	34	10	37	Concerning the issue of the statistical significance of non-unimodal distributions of planetary-wave amplitudes and relative debates, it would be useful to quote: Ambaum, Maarten H. P., 2008: Unimodality of Wave Amplitude in the Northern Hemisphere. J. Atmos. Sci., 65, 1077–1086. [Paolo Michele Ruti, Italy]	Accepted.
14-180	14	10	37	10	37	references in chronological order [Matthias Zahn, United Kingdom]	Accepted.
14-181	14	10	42	12	6	Box 14.2, Table 1: Overlaps with chapter 2 should be avoided (see e.g. the differences between Box 2.4/Table 1 and Box 14.2/Table 1). [Wanner Heinz, Switzerland]	Accepted, Table 1 will be deleted.
14-182	14	10	42	12	16	Table 2 is fine, but Table 1 is not well constrained: which are the outputs from this table? In the extra-tropics what about for Blocking? [ANNALISA CHERCHI, Italy]	Accepted, Table 1 will be deleted.
14-183	14	10	42	14	31	All completely distorted. Little attempt to tell us the details of any phenomenon, the only interest is in trying to fit them somehow into your precious models [VINCENT GRAY, NEW ZEALAND]	Accepted, Table 1 will be deleted, and Table 2 expanded
14-184	14	10	44	11	13	I am having difficulty deciphering the message and meaning of Box 14.2, Table 1. If even included at all, a box like this would be much more useful as a summary somewhere after the detailed discussion of the various modes and phenomena included. The meaning of and differences between "Major Characteristic Phenomena" versus "Fundamental" and "Derived" Variability modes is nebulous and these concepts are never utilized later in the chapter. The CGT is also never again cited. Table 2 is a more useful summary and could also conveniently serve to define acronyms. Suggest deleting Table 1 and perhaps expanding Table 2 to include the additional modes and impacts meant to be covered by Table 1. References back to Chapter 2, Box 2.4 and elsewhere will also have to be included as many of these patterns are defined and discussed there. Verify that conventions used for "phase" (sign) of a mode is consistent with Chapter 2 and throughout the rest of the report. [George Kiladis, USA]	Accepted, Table 1 will be deleted.
14-185	14	10		11		Table 1 also includes the "...?" which must be corrected [Ibouraïma YABI, Benin]	Accepted, but table 1 will be deleted
14-186	14	11	16	11	16	Box 14.2, Table 2, IPO line: Add "New Zealand and the South Pacific Convergence Zone". [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Accepted
14-187	14	11	16	11	16	NAO influence over the North Pacific? The NAM/NAO grouping sounds not well suited here. [Elisa Manzini, Germany]	Accepted, only NAO will be referred in
14-188	14	11	16	11	16	NAM/NAO: SKIP: In summer contributes to anomalously warm and dry conditions over northern Europe. ADD: Controls air mass transport and thus influences temperatures into Europe. [Matthias Zahn, United Kingdom]	Accepted
14-189	14	11	16	11	17	Box 14.2, Table 2, IPO entry. Recommend replacing with: "Modulates decadal variability in Australian rainfall, and high frequency El Niño-Southern Oscillation teleconnections to rainfall, surface temperature, river flow and flood risk over Australia, and decadal changes in rainfall, extreme daily rainfall, the SPCZ and oceanic pH over the South Pacific. References to support these things: e.g. Salinger et al. I. J. Climatol., 2001; Power et al. Climate Dynamics 1999; Folland et al. GRL 2002; Parker et al. J. Geophys. Res, 2007; Griffiths et al. I. J. Climatol., 2007; Wei et al., Geochimica et Cosmochimica Acta, 2009; Kiem et al. Geophys. Res. Lett. 2003; Power, S., M. Haylock, R. Colman, and X. Wang, 2006: The predictability of interdecadal changes in ENSO and ENSO teleconnections. J. Climate, 8, 2161-2180; Power, S., Tseitkin, F., Mehta, V., Torok, S., Lavery, B., 1999: Decadal climate variability in Australia during the 20th century. International J. Climatol. 19, 169-184. [Scott Power, Australia]	Accepted
14-190	14	11	16	11	17	Deescription of AMO: we may include Indian monsoon also along with African monsoon [Madhavan Nair RAJEEVAN, India]	Accepted
14-191	14	11	16			Box 14.2: List of ENSO impacts is limited given its important. Could be expanded to include: large-scale shifts in tropical convection resulting in significant droughts and floods; modulates preferential regions of genesis of	Accepted

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						tropical cyclones; significant interannual variability in global mean temperature, regional sea level... [Brad Murphy, Australia]	
14-192	14	11				Table 2: this table should include the Blocking impacts. Relevant example could be the 2010 Russian fires. [Paolo Michele Ruti, Italy]	Accepted
14-193	14	12	4	12	5	Pacific North American "Pattern", Pacific South American "Pattern" [Wanner Heinz, Switzerland]	Accepted
14-194	14	12	21	13	2	I spotted a new paper: Wang, B., J. Liu, H.-J. Kim, P.J. Webster, and S.-Y. Yim, 2012: Recent change of the global monsoon precipitation (1979–2008). Climate Dynamics, 38, doi: 10.1007/s00382-011-1266-z [David Parker, United Kingdom of Great Britain & Northern Ireland]	Accepted. This reference is added.
14-195	14	12	21			I think the word should be plural monsoon thus missing an s to the end (monsoons) [Ibouraïma YABI, Benin]	Editorial.
14-196	14	12	23	12	24	Remove from "Monsoon" to "is", and include "Monsoons are seasonal phenomena and they are responsible for the majority of summer rainfall within the tropics. In the classical view, a monsoon is driven by" [ANNALISA CHERCHI, Italy]	Taken into account - combined with other comments.
14-197	14	12	23	12	31	The Introductory paragraph about the mean evolution of the monsoon system can include: the intense solar heating in late spring and summer give thermodynamic conditions favoring the occurrence of convection poleward of the equator and thus monsoons can be viewed as seasonal migration of the ITCZ (Plumb 2007), and its poleward extent is related to maximum in boundary-layer moist static energy (Chou et al. 2001, QJ). The monsoons are further viewed as fully coupled ocean-atmosphere-land system. Turner and Annamalai (2012) have provided a succinct summary of the mean monsoons, and a comprehensive review about "Climate change and South Asian monsoon" - The reviewer will be happy to send the manuscript to the concerned lead authors. [H Annamalai, USA]	Taken into account - combined with other comments.
14-198	14	12	23	34	31	Splitting this chapter into sections on "phenomena" and then the regional impacts of these phenomena seems like a good idea, however, in this first section the discussions frequently deviate into descriptions of regional climate variability without any direct ties to the modes of variability. Thus there is a lot of overlap between this section and Section 14.3 and it seems that there are a lot of where some of the regional variability material in 14.2 could be merged into 14.3. [George Kiladis, USA]	Taken into account. Both sections are now rewritten.
14-199	14	12	27	12	27	change: flow of moisture => flow of moist air [Matthias Zahn, United Kingdom]	Rejected. Moisture flow is often used.
14-200	14	12	31	12	31	suggest "resulting in a winter monsoon dry season" [George Kiladis, USA]	Rejected. These words are deleted.
14-201	14	12	33	12	33	remove "globally" and include "From a global point of view" before "The monsoon region" [ANNALISA CHERCHI, Italy]	Accepted. Text revised.
14-202	14	12	33	12	48	While this paragraph summarizes the observed and modeled global monsoons with some remarks about East Asian monsoon, based on available observations and CMIP3 model simulations, Annamalai et al. (2012) noted that the decreasing rainfall tendency over India is associated with rainfall increase over the tropical western Pacific. Within the broader Asian monsoon, regional changes are indeed complex due to dynamical feedbacks. [H Annamalai, USA]	Noted.
14-203	14	12	33	12	48	Points are good, paragraph needs to be rewritten [George Kiladis, USA]	Noted.
14-204	14	12	36	12	36	change "can" with "it could" [ANNALISA CHERCHI, Italy]	Accepted. Text revised.
14-205	14	12	41	12	44	Remove from "From" to "general." Eventually these sentences should be included in the part dedicated to East Asia [ANNALISA CHERCHI, Italy]	Accepted. Moved into East Asian Monsoon sub-section.
14-206	14	12	43	12	43	"anthropogenic" The term should never be used in this contexts, say "changed weather conditions"(1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-207	14	12	45	12	45	by the majority [Matthias Zahn, United Kingdom]	Editorial.

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14-208	14	12	46	12	46	reference for last sentence? [ANNALISA CHERCHI, Italy]	Rejected. Reference given.
14-209	14	12	50	12	58	Regarding the onset of the monsoons - Annamalai et al. (2007) examined the pentad rainfall from both historical and A1B scenario simulations, and noted that "reasonable" models (that simulate the mean and variability of the South Asian monsoon) that have the strongest land-sea thermal contrast indicates an earlier monsoon onset over South Asia, contrast to the results suggested by Inoue and Ueda (2011). [H Annamalai, USA]	Accepted. Text is modified to become more balanced view if CMIP5 results are not available.
14-210	14	12	51	12	51	include "and the main differences are found over the oceans" before "see also Figure" [ANNALISA CHERCHI, Italy]	Accepted. Text revised.
14-211	14	12	52	12	53	How does increased surface evaporation result from an increase in air column vapour? [Adam Monahan, Canada]	Taken into account. Increased surface evaporation comes from warmer surface temperatures, thus the text is modified.
14-212	14	12	52	12	53	The increase of water vapour in the air column is not the cause for increased surface evaporation. [Christian Reuten, Canada]	Taken into account. Increased surface evaporation comes from warmer surface temperatures, thus the text is modified.
14-213	14	12	53	12	53	Careful, increase of humidity does not lead to an increase of surface evaporation but vice-versa [George Kiladis, USA]	Taken into account. Increased surface evaporation comes from warmer surface temperatures, thus the text is modified.
14-214	14	12	54	12	54	include "Despite the response to a warmer climate in terms of the global monsoon system, monsoons may differ in the local response both in terms of precipitation and circulation features because the mechanisms at work may be different (Cherchi et al., 2011)." after "circulation" before "Seasonal". The reference is "Cherchi A, Alessandri A, Masina S, Navarra A (2011) Effects of increased CO2 levels on monsoons. Clim Dyn 37: 83-101" [ANNALISA CHERCHI, Italy]	Accepted. This point and reference is added.
14-215	14	12	54	12	55	remove sentence from "Seasonal" to "monsoon" [ANNALISA CHERCHI, Italy]	Accepted.
14-216	14	12	54	12	55	"Seasonal evolution..." meaning and context of sentence unclear [George Kiladis, USA]	Taken into account. This sentence is deleted.
14-217	14	12	54			The weakening of the (summer) monsoon circulation in the model output warrants an explanation. The driving mechanism for all monsoon systems, as pointed out in line 24, is differential solar heating. Elsewhere it was explained that land surface areas are expected to warm more strongly than oceans under global climate change. This should lead to strengthened monsoon circulations, unless other factors, for example regional solar dimming from aerosol emissions, are offsetting the preferential warming over land. [Christian Reuten, Canada]	Taken into account. Explanation on monsoon circulation weakening is added with cross-reference with Chapter 12.
14-218	14	12		34		I found this section to be quite uneven in how it describes the definition of the various "Climate Phenomena" involved. In many cases, such as the monsoons and the intertropical convergence zones, appropriate physical descriptions are provided. These are phenomena whose definition does not follow from a single particular statistical analysis, and are described appropriately. However, the discussion of the various variability "modes" is quite uneven in its precision. In a few cases – for example, the PDO or the various tropical Atlantic "modes" - careful statistical definitions of these are provided. In contrast, such definitions are absent for other "phenomena", such as the AMO and PNA variability. Without this precision, the incorrect impression can be conveyed about how these phenomena are defined – which is statistically, using specific techniques on specific fields over specific spatial domains. It is vitally important that every "phenomenon" whose definition is specifically statistical in this way should be identified as such, and the definition provided. [Adam Monahan, Canada]	A new structure has been implementet partly as a consequence of this. However, it will not be necessary to go into detailed definitions everywhere if the assessment of the role of the mode/phenomenon in determining regional climate may turn out to be low.
14-219	14	13	5	13	5	Figure 14.1: GMA is never defined and I could not find the Hsu et al. paper cited. This figure would be more credible if a corresponding GMA from present day observations was also shown and agreed reasonably well with the models. The figure shows some odd features, such as monsoon changes over Quebec and Manitoba, and unrealistic extensive "monsoons" in the Atlantic ITCZ and over southern South America and Africa. An alternate view is given in Chapter 9, Figure 9.33, and those regions agree well in some regions but differ	Taken into account. A pdf of Hsu et al. draft was available from TSU at the time of FOD review. Now it is published. Observations and model evaluation of global monsoon area is assessed in Chapter 9. Figure is now re-drawn using up-to-date CMIP5 model

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						substantially in others. Consider consolidation with the material in Chapter 9. [George Kiladis, USA]	results with the same definition with Chapter 9.
14-220	14	13	6	13	6	In caption of fig. 14.1: what do you mean with "global warming" which scenarios/experiments are shown? [ANNALISA CHERCHI, Italy]	Taken into account. Now, scenario is explicitly explained.
14-221	14	13	6			Is it possible to elaborate on the models used? [Ibouraïma YABI, Benin]	Taken into account. "CMIP5 models" is referred.
14-222	14	13	10	14	11	A literature survey indicates contradicting outcome regarding impact of aerosols on Indian monsoon. [S K Satheesh, India]	The role of aerosols as forcing agents will be given more attention in the SOD
14-223	14	13	12	13	13	Supporting references required. [Peter Burt, UK]	Noted; awaiting inputs Accepted
14-224	14	13	12	14	11	There is no clear mention about subseasonal changes (although it is briefly mentioned later in Page 49). [H Annamalai, USA]	Do not seem to have enough published literature on current or future changes at sub-seasonal scales; awaiting further inputs. Reference has been made to MJO 14.2.3.4
14-225	14	13	12	14	11	Stowasser et al. (2009) examined the fidelity of the simulation of monsoon synoptic systems in CMIP3 "reasonable" models, as well in a dynamical downscaling procedure. Even these realistic models fail to capture the in-land progression of monsoon depressions from their genesis locations. While the downscaled results fairly agree with coarse-resolution GCMs, intensity of strong depressions are projected to increase in a warmer climate - as mentioned later (Rajendran and Kitoh studies), results of high-resolution models need to be taken with caution. [H Annamalai, USA]	Edited to accommodate the point made with additional references
14-226	14	13	14	13	14	better to say "rainfall rate does not change" [George Kiladis, USA]	Edited to "total rainfall over larger (land + ocean) area may not show any change"
14-227	14	13	17	13	17	"to exhibit on weather scale to intra-seasonal" may be changed to "to exhibit diurnal to intra-seasonal,". Diurnal variations are very important. [Madhavan Nair RAJEEVAN, India]	I think diurnal changes in monsoon rainfall is not very relevant for the current status of assessment; changed to "daily to intra-seasonal"
14-228	14	13	21	13	24	references on ISOs characteristics are missing (see Goswami, Sperber, Annamalai) [ANNALISA CHERCHI, Italy]	Some material will be included; mostly reference to 14.2.3.4 and other chapters will be made
14-229	14	13	25	13	26	It is not clear how the presence of variability affects the ability to simulate and forecast monsoon. Are the authors suggesting that it is easier, because we seem to understand the variability reasonably well, or that it is harder because there is additional variability that we cannot model well? [Christian Reuten, Canada]	This point will be discussed
14-230	14	13	28	13	28	insert "(ISM)" after "Indian summer monsoon" before "rainfall" [ANNALISA CHERCHI, Italy]	Uniform convention of defining acronym will be followed
14-231	14	13	28	13	38	Please note that both in observations and model simulations larger fraction of severe weak or strong (> 1.5 standard deviations in rainfall) monsoons over South Asia/India are indeed associated with ENSO (Lau and Nath 2000, JC; Prasanth and Annamalai 2012, JAS) - SST anomalies over the tropical Indian Ocean, particularly strong IOD events exert imprints on the regional circulation and rainfall - it may be prudent to begin this paragraph emphasizing the role of "boundary focusing" and refer to Charney and Shukla's 1981 paper. [H Annamalai, USA]	The current assessment is primarily based on post-AR4 literature, and general introduction will emphasize the role of boundary forcing in general. The reference to Prashant and Annamalai 2012 is added with a brief discussion.
14-232	14	13	31	13	32	Are the observed data really sufficient in duration to diagnose a non-stationarity in the relationship between ENSO and the monsoons? Uncertainties in this associated with the short duration of observations should be acknowledged. [Adam Monahan, Canada]	Accepted and suitably edited
14-233	14	13	31	13	33	Fan et al (2010) [Fan, F., Mann, M.E., Lee, S., Evans, J.L., Observed and Modeled Changes in the South Asian Summer Monsoon Over the Historical Period, J. Climate 23, 5193-5205, 2010] analyze the historical CMIP3 simulations, and show that the observed changes in the El Nino/South Asian Summer Monsoon relationship in recent decades can be explained entirely in terms of internal variability alone, given the spread that is observed in trends (which vary greatly in not only magnitude but in sign) in these relationships among multiple realizations of a given model in the CMIP3 historical archive. [Michael Mann, USA]	This is more relevant for SASM as a whole

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14-234	14	13	34			"... have been suggested...": reference? [Christian Reuten, Canada]	Reference added in the revised version
14-235	14	13	35	13	35	What is the relationship between ENSO and winter northeast monsoon, this should be specified [George Kiladis, USA]	This will depend on the existence of published literature; being explored
14-236	14	13	36	13	36	the reference of Kumar et al (2007) (On the recent strengthening of the relationship between ENSO and northeast monsoon rainfall over South Asia, 2006, Pankaj Kumar, K.Rupa Kumar, M.Rajeevan, and A.K.Sahai, 2007, Climate Dynamics, 28, 649-660) may be also included after Zubair and Ropelewski 2006). [Madhavan Nair RAJEEVAN, India]	Noted; to be considered
14-237	14	13	37	13	38	Fan et al (2009) [Fan, F., Mann, M.E., Ammann, C.M., Understanding Changes in the Asian Summer Monsoon over the Past Millennium: Insights From a Long-Term Coupled Model Simulation, J. Climate, 22, 1736-1748, 2009] argue against a prominent role for asian snow cover. [Michael Mann, USA]	SASM
14-238	14	13	37	13	38	It may be mentioned in what way these factors influence the Indian Monsoon [Matthias Zahn, United Kingdom]	It may not be possible to get into extensive discussions on mechanisms beyond providing recent reference; restriction on space is a major constraint
14-239	14	13	40	13	44	To the best of my knowledge, Krishnamurthy and Goswami (2000, JC) were the first to diagnose the relationship between Indian monsoon decadal variability and Pacific decadal variability. [H Annamalai, USA]	Not relevant for AR5 assessment
14-240	14	13	40	13	44	More explanation is required that explains the connection between the two sentences in this paragraph. [Christian Reuten, Canada]	Accepted; edited with minimal increase in length of the paragraph
14-241	14	13	41	13	41	Add Kucharski et al , 2009b after Kucharski (2006) - reference as in existing references. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Noted; to be considered
14-242	14	13	42	13	44	If the chapter wishes to get into the issue of paleo-evidence regarding the past behavior of the Asian Summer Monsoon (ASM) then it should take note of the work of Fan et al (2009) [Fan, F., Mann, M.E., Ammann, C.M., Understanding Changes in the Asian Summer Monsoon over the Past Millennium: Insights From a Long-Term Coupled Model Simulation, J. Climate, 22, 1736-1748, 2009] which notes discrepancies between competing proxy records of past ASM variability (including the drought-based tree-ring records referred to here). [Michael Mann, USA]	Needs to be discussed in the context of SASM. A brief mention and a X-Chapter reference have been added.
14-243	14	13	43			What is the definition of a "mega-drought"? [Adam Monahan, Canada]	This is changed to prolonged and intense droughts with a X-Chapter reference to 5.6.2 and 5.5.2.4
14-244	14	13	46	13	46	It's more appropriate to say "vigorous circulation system" [George Kiladis, USA]	The emphasis is on the convective system, which implies large energetics due to thermodynamical processes; edited
14-245	14	13	46	13	46	"anthropogenic" The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-246	14	13	46	13	56	Projections of mean monsoons: Stowasser et al. (2009, JC) examined the possible causes for the increase in mean monsoon precipitation over South Asia and the weakening of the circulation. They emphasized that regional circulation anomalies forced by suppressed rainfall over the equatorial Indian Ocean (which is a robust feature in many CMIP3 models, Cai et al. 2011; Turner and Annamalai 2012) is perhaps, a candidate for the weakened cross-equatorial monsoon flow - and, the regional air-sea interaction may play a role in the SST warming and promote more evaporation, and hence increase in monsoon rainfall. [H Annamalai, USA]	A discussion on this mechanism has been added
14-247	14	13	46	13	56	ENSO-monsoon relationship: this reviewer has examined this in the CMIP5 models - results support the conclusions made with CMIP3 diagnostics. [H Annamalai, USA]	Needs published literature for assessment
14-248	14	13	46	13	56	Please cite Fan et al (2012) [Fan, F., Mann, M.E., Lee, S., Evans, J.L., Future Changes in the South Asian Summer Monsoon: An Analysis of the CMIP3 Multi-Model Projections, Journal of Climate (in press)] who conclude, citing the abstract: The projected future behavior of the South Asian summer monsoon (SASM) is analyzed for the 720ppm stabilization experiments (SRES A1B) of the Coupled Model Intercomparison Project (CMIP3) simulations. The multimodel ensemble collectively exhibits a clear tendency for weakening SASM	SASM; accepted and the paper should be cited in section "14.3.10.2 Southern Asia", since it focused on scenario projections

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						circulation and strengthening SASM precipitation during the 21st century. These tendencies are consistent, moreover, among multiple realizations for the same model where available. The annual correlation analysis and thermodynamic energy budget analysis are applied to investigate the changes in the monsoon circulation, precipitation (latent heating), and dry static stability across timescales of variation. The strength of the SASM circulation is interpreted in terms of two competing factors: convective latent heating and dry static stability. It is found that on interannual timescales the latent heating wins out over the dry static stability to dominate the interannual fluctuations of the monsoonal circulation. However, the long-term trends in the SASM circulation are governed by the competing effects of the convective latent heating term and the adiabatic term to modify dry static stability in the thermodynamic energy budget. [Michael Mann, USA]	
14-249	14	13	46			The use of the word "Although" at the beginning of the sentence suggests that vigorous convective systems would be expected to be immune to anthropogenic GHG emissions. Either explain why one would expect this or rewrite the sentence. [Christian Reuten, Canada]	editorial comment, rewriting the sentence
14-250	14	13	48	13	49	The results from different models will always be different. Please try to quantify or at least qualify by how much they differ. [Christian Reuten, Canada]	editorial comment, rewriting the sentence. It is possible to quantify the inter-model spread, which we will try to
14-251	14	13	52	13	52	insert "A recent modelling study based on CO2 sensitivity experiments further evidence the dominant role of moisture-driven changes in increasing ISM and Asian-Australian monsoons precipitation (Cherchi et al., 2011)". The reference is "Cherchi A, Alessandri A, Masina S, Navarra A (2011) Effects of increased CO2 levels on monsoons. Clim Dyn 37: 83-101" [ANNALISA CHERCHI, Italy]	Noted; reference added, wording changed
14-252	14	13	52	13	52	a more El Nino like pattern [Matthias Zahn, United Kingdom]	Noted
14-253	14	13	52	13	53	The sentence is not robust, as the relationship between ISM and ENSO weakened in last decades, hence the link with El Nino changes is not straightforward. [ANNALISA CHERCHI, Italy]	Noted; wording changed
14-254	14	13	52	13	53	This sentence lacks a reference and contradicts statements elsewhere, e.g. section 14.2.5. [Christian Reuten, Canada]	Noted
14-255	14	13		49		General comments on the monsoons: the authors need to provide a much better view and current understanding, particularly to those associated with the Indian monsoon (Pages 13-14) and Southern Asia (Page 49) - It is important that the authors bring out where different observational products agree and disagree, and similarly where models agree and disagree - as of now it stands out a mere collection of summary statements from different articles. While discussing about model (coarse or high-resolution) projections, it is VERY important to quote their basic state in simulating the spatial distribution of monsoon precipitation. Many of the discrepancies may be due to model systematic errors. Even in the best of the CMIP3 models, none of them has the ability to capture the climatological rainfall distribution over the broader Asian monsoon region. Much work needs to be done in re-writing these sections. If interest exists, this reviewer will be happy to contribute in this exercise. [H Annamalai, USA]	The first part of the comment, about better view, is not specific; we shall await specific comment. The part on observation shall be considered after carefully examining the coverage in Chapter 2. The last part needs a decision (perhaps X-Chapter) on how much model assessment should be included in this section; also awaiting CA inputs. As suggested in the comment, the reviewer has been invited to be a CA
14-256	14	14	1	14	2	The study by May (2004) also finds an increase in the interannual variability of Indian monsoon rainfall as well as of the monsoon flow in a warmer climate, with a major part of the increase accounted for by a corresponding increase in the interannual SST-variability. (May, W., 2004: Potential future changes in the Indian summer monsoon due to greenhouse warming: Analysis of mechanisms in a global time-slice experiment. Climate Dynamics, 22, 389-414.) [Wilhelm May, Denmark]	Mostly AR4 material
14-257	14	14	1	14	4	It might be interesting to include a few words on the mechanisms leading to the reported changes in the interannual variability of the Indian monsoon and in the length of the monsoon season in a warmer climate. [Wilhelm May, Denmark]	Noted; text added/modified
14-258	14	14	2	14	2	following references should be cited here: [Zeng-Zhen HU, USA]	Pre-AR4, not added
14-259	14	14	2	14	2	Meehl, G. A., and W. M. Washington, 1996: El Niño-like climate change in a model with increased atmospheric CO2 concentrations. Nature, 382, 56-60. [Zeng-Zhen HU, USA]	Pre AR4

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14-260	14	14	2	14	2	Hu, Z.-Z., M. Latif, E. Roeckner, and L. Bengtsson, 2000: Intensified Asian summer monsoon and its variability in a coupled model forced by increasing greenhouse gas concentrations. <i>Geophys. Res. Lett.</i> , 27 (17), 2681-2684. [Zeng-Zhen HU, USA]	Pre AR4
14-261	14	14	2	14	3	the sentence before references should be: "Recent studies suggest that in future scenarios the monsoon season may extend in time" [ANNALISA CHERCHI, Italy]	Noted; text changed
14-262	14	14	3	14	4	references in chronological order [Matthias Zahn, United Kingdom]	Noted;
14-263	14	14	6	14	11	Again, Turner and Annamalai (2012) provide our current understanding on the role of aerosols (sulphate and black carbon) and model deficiencies in representing them. [H Annamalai, USA]	Reference added
14-264	14	14	6	14	11	Analyzing the CMIP3 historical simulations, Fan et al (2010) [Fan, F., Mann, M.E., Lee, S., Evans, J.L., Observed and Modeled Changes in the South Asian Summer Monsoon Over the Historical Period, <i>J. Climate</i> 23, 5193-5205, 2010] find significant discrepancies between observations and historical simulations with regard to the simulated late 20th century changes in SASM strength and SASM-related precipitation. Quoting from the abstract: The behavior in the South Asian summer monsoon (SASM) was analyzed in Coupled Model Intercomparison Project (CMIP3) multimodel historical (20c3m) simulations and in modern observational and reanalysis data. The CMIP3 simulations capture the observed trend of weakening of the SASM circulation over the past half century, but are unable to reproduce the magnitude of the observed weakening trend. While the observations indicate a slight decrease in SASM-related precipitation, the CMIP3 simulations indicate on average a very slight increase, albeit with very large intermodel and intramodel variabilities. The CMIP3 simulations reproduce the observed negative relationship between the SASM and ENSO. The observed weakening trend in this relationship in recent decades, which has been attributed in some studies to anthropogenic forcing, appears to be well within the variability of the CMIP3 multimodel ensemble. For some models, distinct realizations indicate both strengthening and weakening trends that are larger in magnitude than the observed weakening trend. [Michael Mann, USA]	accepted and add a statement as "The CMIP3 simulations capture the observed trend of weakening of the SASM circulation over the past half century, albeit with large intermodel and intramodel variabilities (Fan et al. 2010)"
14-265	14	14	8	14	9	references in chronological order [Matthias Zahn, United Kingdom]	Noted
14-266	14	14	8	14	11	There is a lot of speculation on the role of aerosols on the monsoon and little solid science. Note however that most of the CMIP5 coupled models do have an explicit treatment of direct and indirect aerosol effects. This is not to say there are not uncertainties but the processes are there in some form. [Olivier Boucher, France]	Noted, This point will be discussed, and updated with reference to CMIP5
14-267	14	14	9	14	9	"past variations" are also extensively discussed in chapter 5. [Wanner Heinz, Switzerland]	a cross-chapter reference to Chapter 5 will be made
14-268	14	14	9	14	10	Clearly, current coupled models include aerosol effects, so what do the authors mean by a "lack of explicit treatment"? [Christian Reuten, Canada]	related to comment 266; will be addressed similarly
14-269	14	14	10	14	10	insert ", specifically" after "projections" [ANNALISA CHERCHI, Italy]	Editorial
14-270	14	14	13	15	21	Many definitions about East Asia Monsoon should be mentioned and provided which might be better. [Zong-Ci Zhao, China]	Noted.
14-271	14	14	13			Please consider including the study by Wu et al. (2007) on the trends and correlations of eight components of East Asian Winter Monsoon. Significant trends were found for most of the components. Reference: Wu M. C., K. H. Yeung & Y. K. Leung, 2007: Changes in East Asian Winter Atmospheric Circulation. <i>HKO Reprint No. 709</i> (http://www.weather.gov.hk/publica/reprint/r709.pdf). [Tsz-cheung Lee, Hong Kong]	Taken into account. Combined with other comments for text revision.
14-272	14	14	15	14	34	This paragraph should describe the major climate characters and dominating variability of East Asian monsoon (EAM)(including summer and winter monsoon), which are possibly related to the global climate change. However, it seems that authors of this part have not collected and summed up most of papers published in recent 5-10 years, especially by Chinese, Japanese and Korean investigators. The summary thus made is quite incomplete. The authors wrote this paragraph mainly based or focused on their own research studies. For example, the tropospheric cooling just is one of views to explain the inter-decadal southward shift of summer precipitation pattern, with apparently missing other, more important views such as effects of winter snow over the Tibetan Plateau and tropical SST, which are key coupling forcing factors for EAS. So, this	Taken into account. Combined with other comments for text revision.

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						paragraph should be rewritten with ensuring a balanced interpretation and more reasonable summary of diverse views. [Yihui Ding, China]	
14-273	14	14	15	14	34	An unusually large number of references in this paragraph come from the same associated group of researchers. The relevant citations should be diversified, to more broadly represent the literature. [Adam Monahan, Canada]	Taken into account. Combined with other comments for text revision.
14-274	14	14	16	14	16	insert "it is" after "thus" before "affected" [ANNALISA CHERCHI, Italy]	Editorial.
14-275	14	14	18	14	20	sentence not well written [ANNALISA CHERCHI, Italy]	Accepted. Sentence deleted.
14-276	14	14	22	14	23	references in chronological order [Matthias Zahn, United Kingdom]	Editorial.
14-277	14	14	33			"...stronger impact on the Asian-Pacific climate..." in comparison with what? I also suggest the use of "effect" rather than "impact". [Christian Reuten, Canada]	Taken into account. Combined with other comments for text revision.
14-278	14	14	36	14	38	This sentence makes no sense: how does the main clause preceding "thus" imply that "the EASM change is also regarded as natural variability"? Also, replace "resulted from" by "caused by". [Christian Reuten, Canada]	Taken into account. Combined with other comments for text revision.
14-279	14	14	36	14	47	Anthropogenic increase in CO2 and aerosols both are important for the effect on EAS. But only the effect of aerosols has been assessed in more details. How about the effect of CO2 and other GHGs? Are there any papers available in this aspect? or until now the human effect has not been detected yet? This problem should be clarified. In addition, the wording of this para should be consistent in the context. [Yihui Ding, China]	Taken into account. Combined with other comments for text revision.
14-280	14	14	38	14	38	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-281	14	14	39	14	39	insert "East" before "Asian" [ANNALISA CHERCHI, Italy]	Accepted.
14-282	14	14	49	14	53	references are missing [ANNALISA CHERCHI, Italy]	Taken into account. Reference is added.
14-283	14	14	49	14	53	It is not clear how an eastward displacement of rainfall in the Pacific could favor a "prolonged East Asian summer rainfall season" [George Kiladis, USA]	Taken into account. Reference is added.
14-284	14	14	49	14	53	This paragraph needs references. [Christian Reuten, Canada]	Taken into account. Reference is added.
14-285	14	14	55	15	3	More and more studies of projections of EAS have been emerged since AR4 by suing AR4 model products. A good summary should be anticipated for scientific and practical significance. Unfortunately, the authors have not well and appropriately summarized the results and conclusions in this aspect. As pointed out in comment 1, a balanced valuation should be drawn up based on a wider review of most of peer-reviewed papers published in AR4, in order to acquire objective and equitable conclusions. In addition, an analysis of possible mechanism for future change of EAM should be given, due to significant change observed in last years. It is suggested to avoid pure descriptions of the results. [Yihui Ding, China]	Taken into account. Combined with other comments for text revision.
14-286	14	15	1	15	3	Is the statement "high probabilities" related to IPCC likelihood phrases and if not, could it be sufficiently quantified to use IPCC standard likelihood terminology. Moreover, shorten the sentence to "There is a high probability for future intensification of..." [Christian Reuten, Canada]	Taken into account. IPCC terminology is now used.
14-287	14	15	5	15	5	title should be "Indo-Australian monsoon, including Maritime Continent" [ANNALISA CHERCHI, Italy]	accepted
14-288	14	15	5	15	21	section 14.2.2.3 is focused only on the MC region, what about for the Australian monsoon? [ANNALISA CHERCHI, Italy]	accepted, will be revised along with the consideration of Item-290 (see below)
14-289	14	15	7	15	7	insert "(MC)" after "Maritime Continent" [ANNALISA CHERCHI, Italy]	accepted
14-290	14	15	7	15	9	The definition of the Indo-Australian monsoon given is confusing and contradictory. The Australian monsoon has maximum rainfall in austral summer (DJF). This paragraph only deals with the Indonesian monsoon, not the Australian component. For additional references on the Australian monsoon, see for example: Colman,	accepted and will re-draft this section based on the reference

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						R.A., A.F. Moise and L.I. Hanson (2011), Tropical Australian climate and the Australian monsoon as simulated by 23 CMIP3 models, Journal of Geophysical Research, 116, D10116, doi:10.1029/2010JD015149 and Moise, A.F, R.A. Colman and J.R. Brown, (submitted to Journal of Geophysical Research), Behind Uncertainties in projections of Australian tropical climate: Analysis of 19 CMIP3 models. [Josephine Brown, Australia]	
14-291	14	15	7	15	10	Paragraph needs clarification.Part of the problem is undoubtedly due to the fact that Indonesia has a complex climatology with widely varying rainy seasons from location to location (as shown for instance by Aldrian 2003). [George Kiladis, USA]	Accepted. Text will be revised.
14-292	14	15	7	15	21	Some of this material is also covered in more detail in Section 14.3.11.2, consider merging [George Kiladis, USA]	Taken into account. Combined with other comments for text revision.
14-293	14	15	7	15	21	The definitions of dry and wet seasons at the beginning and end of the paragraph do not agree, in fact contradict each other. [Christian Reuten, Canada]	Accepted. Text will be revised.
14-294	14	15	8	15	8	exhibits [Matthias Zahn, United Kingdom]	Editorial.
14-295	14	15	8	15	9	Boreal winter wet season means during December-February, not July-August. [George Kiladis, USA]	Accepted. Text corrected.
14-296	14	15	10	15	11	what do you mean with "extreme ENSO event" [ANNALISA CHERCHI, Italy]	Rejected. Extreme ENSO events mean ENSO events with large amplitudes.
14-297	14	15	11	15	14	sentence should be "In fact, monsoon contributes to 72% of the total variance of MC climate, while without monsoon signal ENSO contributes to 49.9% of variance and the decadal variability follows with 8.29% of the variance (Aldrian and Djamil, 2008)" [ANNALISA CHERCHI, Italy]	Editorial.
14-298	14	15	11	15	14	The meaning of these percentages is not clear without further explanation. Do they refer to a regional average over the entire country? [George Kiladis, USA]	Taken into account. Text will be modified.
14-299	14	15	12	15	13	The paragraph begins with precipitation. Do the percentages of explained variance also refer to precipitation? [Christian Reuten, Canada]	Noted.
14-300	14	15	14	15	15	sentence should be "Climate change projection over the region, therefore is particularly difficult because of the substantial impact of ENSO and its uncertainties in future climate projections." [ANNALISA CHERCHI, Italy]	Accepted. Text modified.
14-301	14	15	15	15	15	a key [Matthias Zahn, United Kingdom]	Editorial.
14-302	14	15	15	15	16	I think nature will not be influenced by our understanding, I suggest to change this phrase. [Judith Perlwitz, United States of America]	Accepted. Text modified.
14-303	14	15	17	15	17	change "or between the Pacific and the Indian Oceans, thus" with "(i.e. between the Pacific and the Indian Oceans)," [ANNALISA CHERCHI, Italy]	Accepted. Text modified.
14-304	14	15	18	15	18	remove "also"; change "monsoonal" with "monsoon" [ANNALISA CHERCHI, Italy]	Accepted. Text modified.
14-305	14	15	19	15	21	results from Naylor et al 2007 refer to projections? Please specify [ANNALISA CHERCHI, Italy]	Noted. Naylor et al. 2007 refer to 2050 projections.
14-306	14	15	21	15	21	the wet season is now April-June, where? [George Kiladis, USA]	Taken into account. Combined with other comments for text revision.
14-307	14	15	23			See also: Smith, I.N., A.F. Moise and R.A. Colman (2012) Large scale circulation features in the tropical Western Pacific and their representation in climate models, Journal of Geophysical Research, doi:10.1029/2011JD016667, in press, for discussion of both Northern and Southern Hemisphere components of Western Pacific monsoon in CMIP3 models. [Josephine Brown, Australia]	accepted and the paper will be cited.
14-308	14	15	25	15	25	add reference [Matthias Zahn, United Kingdom]	this will be reflected
14-309	14	15	25	15	37	WNPSM region is never defined [George Kiladis, USA]	accepted and will define the domain

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14-310	14	15	25	15	37	After the introduction of the acronym "WNPSM", the long term should no longer be used unless used at the beginning of a sentence. [Christian Reuten, Canada]	accepted
14-311	14	15	27	15	31	Again – are the data really of sufficiently long duration to demonstrate a genuine non-stationarity, rather than just a sampling fluctuation in a correlation coefficient? [Adam Monahan, Canada]	the paper has provided a dynamical explanation, not purely statistical analysis.
14-312	14	15	29	15	29	The relationship between the WNPSM should be specified [George Kiladis, USA]	the meaning of the comment needs to be clarified
14-313	14	15	39	15	56	Scaife et al (2009) should be added, and probably also section 14.3.7.1 on p44: Scaife, A.A., F. Kucharski, C.K. Folland, J. Kinter, D. Fereday, S. Grainger, K. Jin, J.R. Knight, S. Kusunoki, M.J. Nath, T. Nakaegawa, P. Pegion, S. Schubert, P. Sporyshev, J. Syktus, A. Voldoire, J.H.Yoon and T. Zhou, 2009: The CLIVAR C20C Project. Part 1: Selected 20th century changes. <i>Clim. Dyn.</i> 33, 603-614 DOI 10.1007/s00382-008-0451-1. They showed from a variety of models forced with observed SST that in most cases only about half the amplitude of the Sahel drought could be simulated, though phasing was good. This suggests widespread missing processes in current models relevant to African Monsoon changes. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Accepted. We cite this paper as an example of model limitation in the remark concluding the paragraph. A more thorough discussion of the model performance is given. Note the restructuring of the entire chapter
14-314	14	15	39			Sect.14.2.2.5: Although the W.African monsoon is the only climate of Africa to be commonly referred to as a monsoon, I not think it appropriate that other areas of Africa (southern, east, west equatorial) should be neglected since they too have strong seasonality of rainfall. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	The other regions of Africa will be covered in the SOD
14-315	14	15	41		56	It would be interesting to expand this section with the results of the project Analysis of the African Monsoon Multidisciplinary (AMMA) [Ibouraïma YABI, Benin]	Accepted: AMMA is now cited in the first sentence.
14-316	14	15	44	15	48	Other, equally strong, SST influences on the WAM that should be mentioned are the Mediterranean (eg. Rowell 2003, Jung et al. 2006) and ENSO (eg. Janicot et al. 1996; Rowell 2001). Janicot, S., V. Moron, and B. Fontaine, 1996: Sahel droughts and ENSO dynamics. <i>Geophys. Res. Lett.</i> , 23, 515–518. Jung, T; Ferranti L; Tompkins AM, 2006: Response to the summer of 2003 Mediterranean SST anomalies over Europe and Africa. <i>J. Climate</i> , 19, 5439-5454. Rowell, D.P., 2001: Teleconnections between the Tropical Pacific and the Sahel. <i>Q. J. R. Meteorol. Soc.</i> , 127, 1683-1706. Rowell, D.P., 2003: The Impact of Mediterranean SSTs on the Sahelian Rainfall Season. <i>J. Climate</i> , 16, 849-862. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Accepted: we cite the Mediterranean papers and we have increased our emphasis on ENSO (and added citations).
14-317	14	15	46	15	46	Concerning the influence of the Indian Ocean on Sahelian rainfall at decadal scale, it would be really important to mention the results from Bader and Latif (2003). Bader, J., and M. Latif, 2003. The impact of decadal-scale Indian Ocean sea surface temperature anomalies on Sahelian rainfall and the North Atlantic Oscillation, <i>Geophys. Res. Lett.</i> , 30(22), 2169, doi:10.1029/2003GL018426. [Paolo Michele Ruti, Italy]	Accepted. Citation added
14-318	14	15	48	15	53	Sorry to be parochial again, but it now seems that uncertainties in modelling the local direct thermodynamic response to GHGs may be the dominant source of uncertainty over Africa, so I suggest that this be mentioned prior to the other possibilities noted here. See discussion of Rowell (2012, sect.6.2.4) which integrates his analysis with that of Patricola and Cook (2010) and Paeth et al. (2011). Rowell, D.P., 2012: Sources of Uncertainty in Future Changes in Local Precipitation. <i>Clim. Dyn.</i> , in press, DOI: 10.1007/s00382-011-1210-2. Paeth H, Hall NMJ, Gaertner MA, Alonso MD, Moumouni S, Polcher J, Ruti PM, Fink AH, Gosset M, Lebel T, Gaye AT, Rowell DP, Moufouma-Okia W, Jacob D, Rockel B, Giorgi F, Rummukainen M (2011) Progress in regional downscaling of West African precipitation. <i>Atmos Sci Lett</i> 12:75–82. Patricola CM, Cook KH (2010) Northern African climate at the end of the twenty-first century: an integrated application of regional and global climate models. <i>Clim Dyn</i> 35:193–212. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Accepted. This topic is discussed more at length, but we have added the Rowell reference and split the sentence in half to give more weight to the local effects.
14-319	14	15	51	15	53	Concerning the interannual variability of sahelian rainfall, African Easterly Waves are affecting the rainfall distribution and variability in West Africa (Thorncroft and Hodges, 2001; Gu et al., 2004). The link between SST and AEWs activity reveals a strong influence of ENSO events on the variability of disturbances over the Guinean Coasts and the limits in present GCMs (Ruti and Dell'Aquila, 2010). REFERENCES. 1) Thorncroft CD, Hodges K (2001) African Easterly wave variability and its relationship to Atlantic tropical cyclone activity. <i>J Clim</i> 14:1166–1179; 2) Gu G, Adler RF, Huffman GJ, Curtis S (2004) African easterly waves and their association with precipitation. <i>J Geophys Res</i> 109:D04101. doi:10.1029/2003JD003967; 3) Ruti PM and	Accepted: we have added the Gu et al. and Ruti et al citations at the beginning of the paragraph.

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						Dell'Aquila A., 2010 The twentieth century African easterly waves in reanalysis systems and IPCC simulations, from intra-seasonal to inter-annual variability Clim. Dyn. doi:10.1007/s00382-010-0894-z [Paolo Michele Ruti, Italy]	
14-320	14	15	52	15	53	"Xu et al., 2010" [Christian Reuten, Canada]	Accepted. Thanks.
14-321	14	15	54	15	56	Concerning the understanding of ocean dynamics and the interaction with West African monsoon, I would suggest to insert this review paper: Brandt, P., Caniaux, G., Boulrès, B., Lazar, A., Dengler, M., Funk, A., Hormann, V., Giordani, H. and Marin, F. (2011), Equatorial upper-ocean dynamics and their interaction with the West African monsoon. Atmospheric Science Letters, 12: 24–30. doi: 10.1002/asl.287 [Paolo Michele Ruti, Italy]	Rejected: the paper does not address the effect of model biases in the ACT on Sahel seasonal rainfall. It is a purely observational paper and only relates that to the WAM onset.
14-322	14	15	54	15	56	Strong caveats exist for projections over West Africa based on GCM simulations, due to ocean and land systematic errors. This last statement is too assertive, down to a resolution of one week. It would be better to re-phrase considering main caveats for scenarios over the region. [Paolo Michele Ruti, Italy]	Accepted: We have changed the offensive sentence to stress that the agreement is only qualitative and have added caveats as concluding remarks.
14-323	14	15	54	15	56	Concerning future scenarios for the region this paper provide a good analysis of circulation pattern associated with rainfall: Fontaine, B., Roucou, P. and Monerie, P.-A. (2011), Changes in the African monsoon region at medium-term time horizon using 12 AR4 coupled models under the A1b emissions scenario. Atmospheric Science Letters, 12: 83–88. doi: 10.1002/asl.321. [Paolo Michele Ruti, Italy]	Noted. This paragraph is not addressing this issue, so the citation has not been added.
14-324	14	16	3	16	15	Also covered in Section 14.2.3, consider merging [George Kiladis, USA]	Will ensure no double counting
14-325	14	16	9	16	9	suggest "positive trends in NAMS precipitation" [George Kiladis, USA]	accepted ; only to include the word precipitation.
14-326	14	16	9	16	10	The "core" North American monsoon area is northwest Mexico, not in the US as stated. [David Gutzler, USA]	accept and remove the word core from the sentence
14-327	14	16	12	16	12	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-328	14	16	13	16	15	With regard to model resolution, the NAMS has been the target of dynamical downscaling of coarse resolution global climate model output, as a potential means to address the point made here in the text. The effectiveness of such downscaling is still being discussed and debated. [David Gutzler, USA]	rejected, new information from regional models will be incorporated in the regional sections. We will not discuss down scaling here
14-329	14	16	19	16	22	The first sentence need some major rewriting. Simply listing the characteristics without explaining their relationships is of little help to the reader. [Christian Reuten, Canada]	Accepted, although we can not include too much explanations due to number of page restrictions.We changed the text including more explanations.
14-330	14	16	19	18	8	I found the abbreviations of the months confusing (and initially didn't register what was meant). Please consider defining the abbreviations on first usage, giving the month details in full, or the range of the months in full (as is done in some cases e.g.page 41, line12, page 50, line 52). [Peter Burt, UK]	accepted. Included the months.
14-331	14	16	23			Rather than simply referring to the review in Marengo et al. (2010a) the authors should highlight the main points, which probably requires referring to the references in Marengo et al. (2010a). [Christian Reuten, Canada]	taken into account, although we can not extend too much.
14-332	14	16	25	16	27	This interhemispheric trend has reversed in the last two decades e.g. Parker, D.E., Folland C.K., A.A. Scaife, A. Colman, J. Knight, D. Fereday, P. Baines and D. Smith, 2007: Decadal to interdecadal climate variability and predictability and the background of climate change. J. Geophys. Res. (Atmos), 112, D18115 doi 10.1029/2007JD008411. and Thompson, D.W.J., Wallace, J.M., Kennedy, J.J., & Jones, P.D. An abrupt drop in Northern Hemisphere sea surface temperature around 1970. Nature 467, 444-447 (2010). Aerosol forcing in the North Atlantic has decreased again (Chapter 2). Note that Thompson et al (2010) cast considerable doubt on aerosol forcing idea as being dominant because of the large and abrupt interhemispheric Atlantic SST change over just 5 years near 1970. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Text in this section has been modified, but references not added - think that this comment is not related with the subject of this page.
14-333	14	16	26			Please specify when the rainy season occurs in central-east Brazil. [Christian Reuten, Canada]	accepted-The SAMS onset occurs at the end of October and the demise between end of March and

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							end of April,
14-334	14	16	27			Which global model and at what resolution? [Christian Reuten, Canada]	accepted-The Meteorological Research Institute (MRI) global model at 60 km and 20 km resolution projects precipitation increase over Amazonia region and central South America in DJF (Kitoh et al., 2011).
14-335	14	16	28	16	36	Is this discussion relevant for SAMS? [ANNALISA CHERCHI, Italy]	accepted- we removed the sentences.
14-336	14	16	35	16	35	"Persistent precipitation increases" meaning of "persistent" not clear [George Kiladis, USA]	taken into account- we removed the sentence
14-337	14	16	35			What is meant by "persistent precipitation"? [Christian Reuten, Canada]	taken into account- we removed the sentences
14-338	14	16	39	16	39	references in chronological order [Matthias Zahn, United Kingdom]	accepted.
14-339	14	16	41	16	41	Use of the term "pentad" is out of context. [George Kiladis, USA]	accepted. We changed the sentence.
14-340	14	16	41			Please more clearly specify the years that were modelled and which years these are compared with. The phrase "is similar to the 20th century or one pentad later in [the] central monsoon region" is not clear to me. [Christian Reuten, Canada]	taken into account- changed to: The median onset and demise in the future projections (2080-2100) is similar to the 20th century (1979-2000) in the central monsoon region (Bombardi and Carvalho, 2009).
14-341	14	16	45			Do the authors really mean "extended" or rather "delayed". [Christian Reuten, Canada]	taken into account- changed to: Similar changes of a delayed monsoon onset were found in the global tropical regions (Seth et al., 2011).
14-342	14	16	46	16	47	It is unclear based on this section why global warming leads to increased stability. This sentence should be split up and a brief explanation included for the increased stability, possibly with a reference to another section in this report. [Christian Reuten, Canada]	taken into account- We included reference to Chapter 12 and Chou and Chen (2010) where there are discussions about this subject.
14-343	14	16	53	16	53	suggest "Oceanic tropical convection" [George Kiladis, USA]	Add "over ocean" in revision.
14-344	14	16	53	16	53	This is only true for the temporal mean convection. In the instantaneous weather fields, a huge number of individual convective cells are distributed all over the tropics. (see .e.g. Changes in water vapor transports of the ascending branch of the tropical circulation Zahn, M. and R.P. Allan (2011) JGR - Atmospheres, 116, D18111, doi:10.1029/2011JD016206). This should at least be mentioned that the ITCZ is a theoretical artifact gained from averaging vertical wind fields. [Matthias Zahn, United Kingdom]	Add "averaged for a month or longer".
14-345	14	17	7	17	8	This sentence appears to contradict SPCZ section below. Clarify that enhanced equatorial warming causes the ITCZ to move towards the equator (or the SPCZ, if there is evidence of this, although Brown et al. 2012 found no change in the austral wet season SPCZ position). Also, clarify that reduced warming in the Southeast Pacific weakens the SPCZ in the Southeast Pacific only (in agreement with Brown et al. 2012). [Josephine Brown, Australia]	Noted, thanks. Change text to read: "Robust patterns of SST change among CMIP3 models include the equatorial enhanced warming (Liu et al., 2005) and reduced warming in the subtropical Southeast Pacific. The former pattern causes the Pacific convergence zone to move toward the equator (most notable in the Northern Hemisphere), while the latter weakens the convergence zone over the Southeast Pacific"
14-346	14	17	14	17	15	How is the Atlantic ITCZ related to the thermohaline circulation? Are the authors trying to say that the CMIP/PMIP simulations reproduce this relationship? [Christian Reuten, Canada]	A brief discussion has been added
14-347	14	17	17	17	19	Point should be more carefully worded, the cooling is still superimposed on the radiative warming effect of GHGs, resulting in an asymmetry, with more aerosol cooling in the Northern Hemisphere. [George Kiladis, USA]	Edited
14-348	14	17	17			"Preferential cooling" could be confusing to a reader – better to describe it as "a reduction in warming" [Adam Monahan, Canada]	Edited

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Comment No	Chapter	From Page	From Line	To Page	To Line	Comment	Response
14-349	14	17	18	17	18	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-350	14	17	19	17	19	Considerable value can be added by stating what the basic result actual is, that is, a differential cooling in the Northern Hemisphere results in an equatorward shift of the ITCZ, [George Kiladis, USA]	Accepted; edited
14-351	14	17	23	17	23	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-352	14	17	24	17	25	references in chronological order [Matthias Zahn, United Kingdom]	Noted;
14-353	14	17	24	17	27	Please explain better: the Atlantic ITCZ is influenced by the dichotomy in the warming of North and South Atlantic, or by the increase in sulfate aerosols forcing, or both? [ANNALISA CHERCHI, Italy]	Edited
14-354	14	17	25			"secular" is an ambivalent word, which could mean slow or persistent. It would be better to be more specific. [Christian Reuten, Canada]	To be considered
14-355	14	17	31	17	31	"can effect the northern tropics" state what the actual effect is, an equatorward shift in the ITCZ. [George Kiladis, USA]	Edited
14-356	14	17	31	17	35	Too many info in few sentences, and no clear connection among them [ANNALISA CHERCHI, Italy]	To be considered
14-357	14	17	32	17	33	references in chronological order [Matthias Zahn, United Kingdom]	Noted;
14-358	14	17	40			It may be useful to clarify that the "double ITCZ" model bias applies predominantly to the eastern Pacific, where a band of precipitation is simulated near the equator in the Southern Hemisphere that is not seen in observations (except briefly in March/April) - cf. discussion in Chapter 9 on model biases and de Szoeke and Xie (2008). The term "double ITCZ" has also been applied to the overly zonal orientation of the SPCZ precipitation band in the western/central Pacific, although this is distinct from the eastern Pacific band in many models, and so this usage may be confusing. See also Brown, J. R., S. B. Power, F. P. Delage, R. A. Colman, A. F. Moise and B. F. Murphy (2011), Evaluation of the South Pacific Convergence Zone in IPCC AR4 climate model simulations of the 20th century, Journal of Climate, 24, 1565-1582. [Josephine Brown, Australia]	Edited with reference included
14-359	14	18	2			To be consistent with other sections in this chapter, "Interdecadal Pacific Oscillation" should be replaced by "PDO". [Christian Reuten, Canada]	Noted, will homogenise.
14-360	14	18	8	18	14	Should probably state that this paragraph is based on results in Brown, J. R., A. F. Moise and F. P. Delage (2012), Changes in the South Pacific Convergence Zone in IPCC AR4 future climate projections, Climate Dynamics (in press), doi:10.1007/s00382-011-1192-0. Further studies based on CMIP5 models will need to be described here also. [Josephine Brown, Australia]	Noted, will add citation. Have also received extra material from JB (in CA role) and will add CMIP5 reference(s).
14-361	14	18	20	18	21	"tropical overturning circulation" is never defined, does this mean the Hadley circulation? [George Kiladis, USA]	Noted. Text modified.
14-362	14	18	20			Citation is Brown et al. (2012) as this paper is currently "in press" and will be published in 2012. [Josephine Brown, Australia]	Noted, changed.
14-363	14	18	24	18	30	Given the difficulty in correctly simulating ENSO variability in the CMIP3 models – how seriously should we take these predictions of changes of SPCZ dependence on ENSO in these models? [Adam Monahan, Canada]	SPCZ response in relation to ENSO is modelled reasonably well by many models, but ENSO simulation and changes to ENSO remain uncertain. Have now included new CMIP5-related discussion.
14-364	14	18	26			See above, citation is Brown et al. (2012). [Josephine Brown, Australia]	Noted.
14-365	14	18	28			Remove" cf. to the parenthesis for the sake of harmonization [lbouaraïma YABI, Benin]	Noted.
14-366	14	18	35	18	36	suggest saying "weakening or displacement of this feature couases drier than normal conditions" [George Kiladis, USA]	accepted. Included.

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14-367	14	18	41	18	42	The way it is written it sounds like 50% of the models indicate increases in precipitation, so that 50% must show decreases, therefore the signal is indeterminate. Clarification needed. [George Kiladis, USA]	taken into account- The sentence was changed to mean that: 9 models out of 18 from CMIP3 reproduced this dipole precipitation pattern.
14-368	14	18	44	18	44	the dipole pattern should be more fully defined in the first lines of this section, and then tied directly to the SACZ [George Kiladis, USA]	acceptedIncluded in the first paragraph:The dominant mode of austral summer precipitation variability over South America depicts a dipole pattern, with one center over SACZ region and another over SESA.
14-369	14	18	46	18	46	another one [Matthias Zahn, United Kingdom]	editorial
14-370	14	18	48	20	2	Most of this is general background and introductory material, but we have read through sections mentioning ENSO already, so the order of presentation seems wrong. Consider moving this block of text to define ENSO closer to the start of Section 4.2. There is a similar issue with the NAO, which is defined in Section 14.2.9.1 but mentioned (often in detail) many times in the sections beforehand! [Peter Burt, UK]	Should be page 19/line 48 to page 20/line 2. Text and chapter structure significantly modified, this issue resolved
14-371	14	18	55	18	55	It's not clear what the LLJ is and why it is important. This should come before a discussion of its variability. [George Kiladis, USA]	accepted- We included more information on LLJ.
14-372	14	19	4	19	46	I would just like to comment that 14.2.3.4 and 14.2.3.5 were particularly well written – they were succinct, and carefully expressed [Adam Monahan, Canada]	Thanks!
14-373	14	19	9			"areas of up to 20,000km2" could be repaced with other straightforward scale of measure" : it is not certain why area is chosen here. [KAZUYOSHI OOUCHI, JAPAN]	Perhaps sounds too precise. Text changed top "areas of up to approximately 20,000 km2"
14-374	14	19	15			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted.
14-375	14	19	16	19	16	see also review by Lengaigne, M., Boulanger, J., Menkes, C., & Delecluse, P. (2004). Westerly Wind Events in the Tropical Pacific and Their Influence on the Coupled Ocean-Atmosphere System: A Review. AGU Monograph [Eric Guilyardi, France]	Noted, but rejected.
14-376	14	19	16	19	16	"excites" [George Kiladis, USA]	Noted - thanks.
14-377	14	19	17			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted.
14-378	14	19	20	19	20	references in chronological order [Matthias Zahn, United Kingdom]	Noted.
14-379	14	19	20			"although progress has been made in recent years" : Chikira and Sugiyama (2010) should be added to the reference [KAZUYOSHI OOUCHI, JAPAN]	Noted. Reference not included.
14-380	14	19	21	19	21	Add to Bell et al (2009) the original reference on this topic: Ineson and Scaife (2009), already in refs. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Think this should be page 21, line 19, not other way round as listed. Noted, will insert reference.
14-381	14	19	23			This could imply that the period is 2x28months so suggest ".and back again" after "westerlies" [Adam Scaife, United Kingdom of Great Britain & Northern Ireland]	Noted - this comment is regarding line 33, not 23. Will make change.
14-382	14	19	26			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted - ignored. OK to use if cited paper an example from many.
14-383	14	19	28	19	46	Among the effects of QBO, the effects on tropospheric circulation also may be mentioned. For example, there is a good research establishing the relationship between QBO and Tropical Cyclones (Gray, W.M, 1984, Mon Wea Rev). [Madhavan Nair RAJEEVAN, India]	Noted. No change made, as does not add to discussion at hand regarding the QBO and climate change.
14-384	14	19	28	19	48	QBO should be added toe synthesis figure at page 12, line 14 [Matthias Zahn, United Kingdom]	Noted - thanks. QBO added.
14-385	14	19	31			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted - ignored. OK to use if cited paper an example from many.
14-386	14	19	37			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted, done.

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14-387	14	19	38	19	38	references in chronological order (also at several other places) [Matthias Zahn, United Kingdom]	Noted - thanks.
14-388	14	19	39			Remove "e.g." to the parenthesis for the sake of harmonization [Ibouraïma YABI, Benin]	Noted - ignored. OK to use if cited paper an example from many.
14-389	14	19	42	19	46	<p>I suggest this paragraph should be read: It has been unclear how the QBO will respond to future climate change related to greenhouse gas increase and recovery of stratospheric ozone. Climate models assessed in the AR4 did not simulate the QBO as they lacked the necessary vertical resolution (Kawatani et al., 2011). However, recent studies without using gravity wave parameterization (Kawatani et al., 2011; Kawatani et al., 2012) showed that the QBO period and amplitude become longer and weaker, and the downward penetration into the lowermost stratosphere is more curtailed in a warmer climate. They attribute the tendency to the model observation that the effect of increase in the equatorial upwelling (stronger Brewer-Dobson circulation; Butchart and Scaife, 2001; Butchart et al. 2006; Garcia and Randel 2008; McLandress and Shepherd 2009; Okamoto et al. 2010) dominates the effect of increase in wave forcing (more convective activities). Similar studies with the gravity wave parameterization (Giorgetta and Doege, 2005; Watana+G384be and Kawatani, 2012) gave conflicting results depending on their simulated changes in the intensity of the Brewer-Dobson circulation.</p> <p>Newly cited papers in the above comment: Butchart, N., and A. A. Scaife, 2001: Removal of chlorofluorocarbons by increased mass exchange between the stratosphere and troposphere in a changing climate. <i>Nature</i>, 410, 799–802.</p> <p>Butchart, N., and Coauthors, 2006: Simulations of anthropogenic change in the strength of the Brewer–Dobson circulation. <i>Climate Dyn.</i>, 27, 727–741.</p> <p>Garcia, R., and W. J. Randel, 2008: Acceleration of the Brewer–Dobson circulation due to increases in greenhouse gases. <i>J. Atmos. Sci.</i>, 65, 2731–2739.</p> <p>Kawatani, Y., K. Hamilton, A. Noda, 2012: The effects of changes in sea surface temperature and CO2 concentration on the quasi-biennial oscillation, <i>J. Atmos. Sci.</i>, doi:http://dx.doi.org/10.1175/JAS-D-11-0265.1 http://journals.ametsoc.org/doi/abs/10.1175/JAS-D-11-0265.1</p> <p>McLandress, C., and T. G. Shepherd, 2009: Simulated anthropogenic changes in the Brewer–Dobson circulation, including its aboveextension to high latitudes. <i>J. Climate</i>, 22, 1516–1540.</p> <p>Okamoto, K., K. Sato and H. Akiyoshi, 2011: A study on the formation and trend of the Brewer-Dobson circulation, <i>J. Geophys. Res.</i>, 116, D10117, doi:10.1029/2010JD014953.</p> <p>Watanabe, S. and Y. Kawatani, 2012: Sensitivity of the QBO to mean tropical upwelling under a changing climate, <i>J. Meteor. Soc. Japan</i>, in press. [Akira Noda, Japan]</p>	Noted - thanks. Will change text to incorporate cited material.
14-390	14	19	45	19	45	insert "of them is" after "neither" [ANNALISA CHERCHI, Italy]	Noted. Text in this paragraph modified.
14-391	14	19	51	19	52	If the "Christ Child" origin of the El Nino name is to be noted, it should also be noted that events tend to peak at the end of the calendar year [Adam Monahan, Canada]	revised
14-392	14	19		21		It should be mentioned on the relationships between ENSO and warm pool over West tropical Pacific. [Zong-Ci Zhao, China]	This is not relevant to this part.
14-393	14	20	1	20	1	suggest "amplified" instead of "grown" [George Kiladis, USA]	corrected
14-394	14	20	2	20	2	"referred to as the Bjerknes feedback" [George Kiladis, USA]	corrected
14-395	14	20	2			"referring"? [Christian Reuten, Canada]	corrected

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14-396	14	20	6	20	23	this paragraph tries to convey too much complexity with too few words. Suggest just talking about the uncertainties in more general terms instead of incomplete mechanistic explanations [George Kiladis, USA]	Modified
14-397	14	20	7	20	7	reanalyses are not used to analyze SST gradients [George Kiladis, USA]	changed to reconstructed
14-398	14	20	21	20	21	Using terms "El-Niño like or La Niña like" when describing a mean state change causes much confusion for non-specialists. I suggest either to explicit them ("mean that looks like to peak of EN or LN") or, at minima, to use quotes [Eric Guilyardi, France]	El Nino-like literally indicates look-like the peak of El Nino. These terms has been used in AR4 too.
14-399	14	20	27			This mentions shoaling of the tropical Pacific thermocline, and I think its causes and consequences should be expanded upon. Is it caused by changes in vertical mixing? By wind-driven tilt of the thermocline? Will it lead to changes in the frequency and strength of ENSO? To changes in the strength of atmosphere-ocean coupling associated with ENSO? Will it change the overall heat and salinity budget of the ocean? [Brent Lofgren, USA]	Because of the limitation of page we rather mention the fact that actually happened.
14-400	14	20	29	20	35	These lines have to do with global circulation, whereas the section is supposed to be about the Pacific [George Kiladis, USA]	Changes mentioned here is about the tropical Pacific circulation, which has been mentioned.
14-401	14	20	29	20	35	How do I reconcile these two sentences? They seem contradictory. [Adam Monahan, Canada]	Former descripts overall change for 20C and the latter indicates the recent decades.
14-402	14	20	33	20	35	two references may be added, that fond an intensification of the tropical circulation, too: 1. Zahn, M., and R. P. Allan (2011), Changes in water vapor transports of the ascending branch of the tropical circulation, J. Geophys. Res., 116, D18111, doi:10.1029/2011JD016206. 2: Sohn, B. J., and S.-C. Park (2010), Strengthened tropical circulations in past three decades inferred from water vapor transport, J. Geophys. Res., 115, D15112, doi:10.1029/2009JD013713 [Matthias Zahn, United Kingdom]	Added.
14-403	14	20	33	20	35	Vecchi et al. 2006, report a weakening, not an intensification of the tropical circulation. [Matthias Zahn, United Kingdom]	it was correctly cited.
14-404	14	20	41	20	54	Additional studies dealing with the southern hemisphere support these conclusions. Recommend adding Power et al. Climate Dynamics 1999 and Power and Smith 2007 to refs given on lines 40-42, Braganza et al. 2010 after Yan et al. on line 42, [Scott Power, Australia]	cited
14-405	14	20	43	20	57	Grammar and style of this paragraph need to be improved. [Christian Reuten, Canada]	Technical editing will be done before publishing.
14-406	14	20	46	20	47	"Central Pacific El Nino events" have not been introduces, yet, and should be briefly described. The same problem occurs on page 21, lines 24-26. The description is provided in section 14.2.4.4, which should maybe be moved up just before section 14.2.4.2. [Christian Reuten, Canada]	CP El Nino has been discussed in Ch. 2 and 9 already, but this part moved to 'different flavour of El Nino'.
14-407	14	20	46	20	48	Phrase should be more cautious as some studies dispute both the CP/EP distinction and an increased occurrence of CP (listed below) [Eric Guilyardi, France]	flavour of ENSO has been rewritten with considerion on the balance with other chapter and other literatures.
14-408	14	20	46			"Central Pacific El Nino" events haven't been defined yet [Adam Monahan, Canada]	This part moved to 'different flavour of El Nino'.
14-409	14	20	47	20	47	may add following reference: Hu, Z.-Z., A. Kumar, B. Jha, W. Wang, Bohua Huang, and Boyin Huang, 2012: An analysis of warm pool and cold tongue El Niños: Air-sea coupling processes, global influences, and recent trends. Clim. Dyn., DOI: 10.1007/s00382-011 [Zeng-Zhen HU, USA]	this part moved to 'different flavour of El Nino'.
14-410	14	20	48	20	48	"An" increasing trend rather than "the" increasing trend would be more appropriate [Eric Guilyardi, France]	Changed.
14-411	14	20	49	20	49	change "which claimed to be" with "possibly" [ANNALISA CHERCHI, Italy]	changed
14-412	14	20	52	20	52	"be resulted" should read "result" [Eric Guilyardi, France]	changed
14-413	14	20	54	20	54	A simpler mechanism has also been proposed. Recommend adding: "...or truly random changes in El Niño-Southern Oscillation activity from decade to decade linked to chaotic variability in the atmosphere (Power et	Added

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						al.; 2006; Power and Colman 2006"). References Power, S.B., and R. Colman, 2006: Multi-year predictability in a coupled general circulation model. <i>Climate Dynamics</i> , 26, 247-272. Power, S., M. Haylock, R. Colman, and X. Wang, 2006: The predictability of interdecadal changes in ENSO and ENSO teleconnections. <i>J. Climate</i> , 8, 2161-2180. [Scott Power, Australia]	
14-414	14	20	54	21	2	McPhaden et al. 2011 argued that the character of El Niño during 1980-2010 has varied naturally and that these variations projected onto changes in the background state because of the asymmetric spatial structures of CP and EP El Niños. With is consistent with our results (Hu et al. 2012). It may be necessary to add this argument. [Zeng-Zhen HU, USA]	Text and structure changed, this discussion included under 'different flavours of ENSO'
14-415	14	20	54	21	2	McPhaden, M. J., T. Lee, and D. McClurg, 2011: El Niño and its relationship to changing background conditions in the tropical Pacific Ocean. <i>Geophys. Res. Lett.</i> , 38, L15709, doi:10.1029/2011GL048275. [Zeng-Zhen HU, USA]	REFadded
14-416	14	20	54	21	2	Hu, Z.-Z., A. Kumar, B. Jha, W. Wang, Bohua Huang, and Boyin Huang, 2012: An analysis of warm pool and cold tongue El Niños: Air-sea coupling processes, global influences, and recent trends. <i>Clim. Dyn.</i> , DOI: 10.1007/s00382-011. [Zeng-Zhen HU, USA]	REF added
14-417	14	21	1	21	1	insert "or remain unchanged (Vecchi and Wittenberg, 2010)" after "weaken". The reference is "Vecchi GA, Wittenberg AT (2010) El Nino and our future climate: where do we stand? <i>Wiley Interdisciplinary Reviews: Climate Change</i> , DOI:10.1002/wcc.33" [ANNALISA CHERCHI, Italy]	added.
14-418	14	21	1	21	1	"very likely" seems too weak. Recommend replacing with: " almost certainly" [Scott Power, Australia]	Changed.
14-419	14	21	2	21	2	may add following sentence: "although its variability may change (Solomon and Newman 2011, Hu et al. 2012)." [Zeng-Zhen HU, USA]	papers cited
14-420	14	21	2	21	2	Solomon, A., and M. Newman, 2011: Decadal predictability of tropical Indo-Pacific Ocean temperature trends due to anthropogenic forcing in a coupled climate model. <i>Geophys. Res. Lett.</i> , 38, L02703, doi:10.1029/2010GL045978. [Zeng-Zhen HU, USA]	papers cited
14-421	14	21	2	21	2	Hu, Z.-Z., A. Kumar, B. Jha, and B. Huang, 2012: An analysis of forced and internal variability in a warmer climate in CCSM3. <i>J. Climate</i> (in press and published online). [Zeng-Zhen HU, USA]	papers cited
14-422	14	21	4	21	10	As there is a debate on the existence or distinction of EP/CP (as explain in 14.2.4.4 and already illustrated in fig 14.3), another figure less contentious should be chosen to illustrate ENSO changes [Eric Guilyardi, France]	Different flavour of ENSO part is modified and mentioned the debate.
14-423	14	21	12			Some papers have analyzed in detail how coupled models are reproducing ENSO. Here it woul be useful to refer to Chapter 9 or to quote at least a relevant review such as: AchutaRao K, Sperber KR (2006) ENSO simulation in coupled ocean-atmosphere models: are the current models better? <i>Clim Dyn</i> 27:1–16 [Paolo Michele Ruti, Italy]	we can add the model's capability in simulating ENSO but the space is limited and main theme in this part is ENSO teleconnection. ENSO simulation is in ch. 9.
14-424	14	21	14	21	14	'ENSO event causes' should better be 'ENSO events influence the probability' [Matthias Zahn, United Kingdom]	Changed.
14-425	14	21	14	21	16	sentences should be "ENSO causes severe weather events and significantly influences ecosystems, agriculture, freshwater supplies, and tropical cyclone activity worldwide. The ENSO signal travels all over the globe through atmospheric waves, and this is called 'atmospheric ENSO's teleconnection'." [ANNALISA CHERCHI, Italy]	Changed.
14-426	14	21	14	21	26	Grammar and style of this paragraph need to be improved. [Christian Reuten, Canada]	Modified and technical editor will be checked in the final stage.
14-427	14	21	18	21	18	insert "(Horel and Wallace, 1981)" after "condition" [ANNALISA CHERCHI, Italy]	Added.
14-428	14	21	19	21	19	Of relevance for the assessment of the regional impacts, it is necessary to note that the processes responsible	This may be too specific to mention but we expand

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						for the "stratosphere wave path" of the ENSO teleconnection relevant to the North Atlantic and European region is commonly not resolved in standard climate models as demonstrated by means of numerical experiments with high top and low top models (Cagnazzo, C., and E. Manzini (2009), Impact of the stratosphere on the winter tropospheric teleconnections between ENSO and the North Atlantic and European Region. J. Climate 22, 1223-1238. DOI: 10.1175/2008JCLI2549.1). The processes in question are related to the occurrence of sudden stratospheric warming, represented only in the high top model. [Elisa Manzini, Germany]	little a bit more this part.
14-429	14	21	22			The expansion of the warm pool is a change in the mean state – why wasn't it discussed in 14.2.4.1? [Adam Monahan, Canada]	included
14-430	14	21	23	21	24	Suggestion for rephrasing: "It is unclear whether the eastward shift of tropical convection is related to longitudinal shifts in El Niño maximum SST anomaly". [Eric Guilyardi, France]	changed
14-431	14	21	28	22	15	This section could be summarized and provide a more balanced perspective on the debate about the existence of the CP/EP distinction [Eric Guilyardi, France]	This part rewritten.
14-432	14	21	28	22	15	This section duplicates that of Chap 1, p73 lines 3-25 (which provides the more balanced view discussed above) [Eric Guilyardi, France]	This is ENSO section, which includes more than ch. 2. This part has been modified.
14-433	14	21	30	21	30	confusing. Suggestion: "Beyond the canonical view of the EP El Niño pattern, another SST structure has been observed..." [Eric Guilyardi, France]	Added
14-434	14	21	31	21	31	Trenberth and Stepaniak [George Kiladis, USA]	corrected
14-435	14	21	33	21	33	Yeh et al may be written as Yeh et al. (2009) [Madhavan Nair RAJEEVAN, India]	corrected
14-436	14	21	35	21	35	please add "Hu et al. 2012" after "Kug et al., 2009" [Zeng-Zhen HU, USA]	Added
14-437	14	21	35	21	35	Kug, J.-S., F.-F. Jin, and S.-I. An, 2009: Two types of El Niño events: Cold tongue El Niño and warm pool El Niño. J. Climate, 22, 1499-1515, doi: 10.1175/2008JCLI2624.1. [Zeng-Zhen HU, USA]	REF for 14-436
14-438	14	21	35	21	35	Hu, Z.-Z., A. Kumar, B. Jha, W. Wang, Bohua Huang, and Boyin Huang, 2012: An analysis of warm pool and cold tongue El Niños: Air-sea coupling processes, global influences, and recent trends. Clim. Dyn., DOI: 10.1007/s00382-011 [Zeng-Zhen HU, USA]	REF for 14-436
14-439	14	21	38	21	38	insert ", or the TNI (Trans-Niño Index) defined by Trenberth and Stepaniak (2001)" at the end of the sentence [ANNALISA CHERCHI, Italy]	added
14-440	14	21	38	21	38	suggestion to add: "and no clear and agreed definition has emerged yet". [Eric Guilyardi, France]	added.
14-441	14	21	43			'Jin-Yi Yu' is he an author? if yes specify the year [Ibouraïma YABI, Benin]	This figure has been replaced
14-442	14	21	46	21	46	please add "Hu et al. 2012" after "Kug et al., 2009" [Zeng-Zhen HU, USA]	added
14-443	14	21	46	21	46	Hu, Z.-Z., A. Kumar, B. Jha, W. Wang, Bohua Huang, and Boyin Huang, 2012: An analysis of warm pool and cold tongue El Niños: Air-sea coupling processes, global influences, and recent trends. Clim. Dyn., DOI: 10.1007/s00382-011 [Zeng-Zhen HU, USA]	REF for 14-442
14-444	14	21	51	21	51	It has been showed => it has been shown [Matthias Zahn, United Kingdom]	corrected
14-445	14	21	54	21	56	There is no physical reason to think that individual EOF modes are forced by individual driving mechanisms – as EOFs will not generally correspond to individual dynamical modes that can be "excited" by the right forcing. This needs to be expressed more carefully. [Adam Monahan, Canada]	corrected
14-446	14	21	55	21	55	reference incomplete [ANNALISA CHERCHI, Italy]	corrected
14-447	14	21	55	21	55	Muller and Roeckner: is this meant to be a citation ? [Matthias Zahn, United Kingdom]	corrected

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14-448	14	21	55			"Mueller and Roeckner, 2008" [Christian Reuten, Canada]	Corrected
14-449	14	22	3	22	3	eventually "El nino-like" ... [ANNALISA CHERCHI, Italy]	corrected
14-450	14	22	14	22	15	on this topic on non-distinction, also refer to and discuss: Giese, B. S., and S. Ray (2011): El Niño variability in simple ocean data assimilation (SODA), 1871–2008, J. Geophys. Res., 116, C02024, Newman, M., S.-I. Shin, and M. A. Alexander (2011), Natural variation in ENSO flavors, Geophys. Res. Lett., 38, L14705, doi:10.1029/2011GL047658. Na, H., Jang, B.-G., Choi, W.-M., & Kim, K.-Y. (2011). Statistical simulations of the future 50-year statistics of cold-tongue El Niño and warm-pool El Niño. Asia-Pacific Journal of Atmospheric Sciences, 47(3), 223–233. doi:10.1007/s13143-011-0011-1 Nicholls, N., 2008: Recent trends in the seasonal and temporal behaviour of the El Niño Southern Oscillation. Geophysical Research Letters, 35(L19703) [Eric Guilyardi, France]	added
14-451	14	22	14	22	15	There is also evidence that these El Nino Modoki do not represent distinct aspects of ENSO variability from "East Pacific" El Nino events, with some non-stationary change leading to one becoming more dominant over the other, but rather that ENSO variability is high dimensional (but stationary) such that sometimes SST anomalies take certain forms and sometimes others in response to variable forcing. I strongly suggest that this section address this point and include a reference to Newman et al., GEOPHYSICAL RESEARCH LETTERS, VOL. 38, L14705, 7 PP., 2011 doi:10.1029/2011GL047658. [Adam Monahan, Canada]	This part has been revised and ref is added.
14-452	14	22	15	22	15	Suggestion to add: "Following the asymmetric nature of the warm and cold phases of ENSO, Kug et al. (2011) could not identify such distinctions for La Niña, both in observations and in the CMIP3 models" Kug, J.-S., & Ham, Y.-G. (2011). Are there two types of La Nina? Geophysical Research Letters, 38(16). doi:10.1029/2011GL048237 [Eric Guilyardi, France]	Added
14-453	14	22	15	22	15	I suggest to also cite Newman, M., S.-I. Shin, and M. A. Alexander (2011), Natural variation in ENSO flavors, Geophys. Res. Lett., 38, L14705, doi:10.1029/2011GL047658. [Judith Perlwitz, United States of America]	Added
14-454	14	22	19	22	44	A link/consistency check with corresponding section in Chap 9 is needed here [Eric Guilyardi, France]	Agreed
14-455	14	22	22	22	23	are you sure that the "global average is subtracted" to build the index? [ANNALISA CHERCHI, Italy]	To be checked - this correct
14-456	14	22	24	22	27	Refer back to Chapter 2, Box 2.4 for map of PDO pattern, sign convention. [George Kiladis, USA]	Cross referencing and better coordination with Ch2 is now ensured
14-457	14	22	25	22	26	"an index of which is the..." What does that mean? [Christian Reuten, Canada]	Acknowledged. Text changed
14-458	14	22	33	22	34	This sentence misunderstands Power et al (1999). Power et al did not use the PDO pattern as defined earlier in section 14.2.5.1 but a different worldwide SST eigenvector pattern defined by Folland et al (1999). Power et al (1999) termed this the IPO. This is quite like the PDO pattern defined for the north Pacific but with strong variance in the south Pacific and variance elsewhere in the world. Folland et al (2002) (Folland, C.K., J.A. Renwick, M.J. Salinger and A.B. Mullan, 2002 is: Relative influences of the Interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence Zone. Geophys. Res. Lett., 29 (13): 10.1029/2001GL014201) compare the IPO and PDO. The IPO pattern was recalculated by Parker et al (2007) (in the refs) though this remains similar. The IPO differs from the PDO in being much larger scale and as important in the southern hemisphere as the northern, with variance outside the Pacific. It is a modified version of the quasi-global ENSO SST pattern. Folland et al (1999) is: Folland, C.K., Parker, D.E., Colman, A. and R. Washington, 1999: Large scale modes of ocean surface temperature since the late nineteenth century. Chapter 4, pp73-102 of Beyond El Nino: Decadal and Interdecadal Climate Variability. Ed: A. Navarra. Springer-Verlag, Berlin, pp 374. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Noted. The sentence will be made more clear and section revised
14-459	14	22	33	22	34	Re "the PDO has also been termed the "Inter-decadal Pacific Oscillation". But in Box 14.2 (page 14-11) the PDO and IPO are listed as distinct modes of variability. [David Sauchyn, Canada]	Rejected, because PDO is the manifestation of IPO in the North Pacific while IPO is near-global
14-460	14	22	34	22	34	The PDO is the leading EOF of Nth Pacific decadal variability. The PDO index is known to include a convolution of ENSO and Aleutian Low variability (Newman et al. JCLim 2003). Aleutian Low variability will	Noted. This will be corrected and sentence changes - see also 14-459

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						<p>include a good deal of variability that has no commonality with variability over the South Pacific or the Indian Ocean. The Interdecadal Pacific Oscillation (IPO) on the other hand, is derived from an analysis near-global SST (Folland et al. 1997; Parker et al. 2007). The interdecadal component of the IPO and the PDO are known to be very similar (Power et al. 1999). The PDO can be regarded as the North Pacific manifestation of the IPO (Power et al. J. Climate 2006). It is not optimal to use the PDO when one is considering variability beyond the North Pacific, e.g. in the South Pacific or the Indian Ocean. I therefore recommend that a sentence or two is given on this distinction. It is incorrect to say that the IPO is just a different name for the PDO. They are closely related but the PDO is the manifestation of the IPO in the North Pacific while the IPO is near-global. When considering the globe it is better to use an IPO index as has been done in many previous studies. A few refs given below.</p> <p>References: Arblaster et al. 2002: Climate Dynamics, 18, 519-531, DOI: 10.1007/s00382-001-0191-y Folland CK, Parker DE, Colman AW, Washington R. (1998) Largescale modes of ocean surface temperature since the late nineteenth century. Hadley Centre, UK Meteorological Office, Clim Res Tech Note, CRTN 81, 45 pp. Meehl, G.A. and A. Hu, 2006: J. Climate. 22, 780-792. Parker et al., 2007: J. Geophys. Res., 112, D18115, doi:10.1029/2007JD008411. Power, S., M. Haylock, R. Colman, and X. Wang, 2006: The predictability of interdecadal changes in ENSO and ENSO teleconnections. J. Climate, 8, 2161-2180. Power, S., Folland, C., Colman, A., and V. Mehta, 1999: Inter-decadal modulation of the impact of ENSO on Australia. Climate Dynamics, 15, 319-324. [Scott Power, Australia]</p>	
14-461	14	22	35	22	35	"The PDO is closely linked to winter temperature and precipitation anomalies over North America." However, from above, the PDO is poorly handled by the models. [Richard Keen, USA]	Acknowledged
14-462	14	22	36	22	36	please add "Hu and Huang 2009" [Zeng-Zhen HU, USA]	Will be assessed
14-463	14	22	36	22	36	Hu, Z.-Z. and B. Huang, 2009: Interferential impact of ENSO and PDO on dry and wet conditions in the U. S. Great Plains. J. Climate, 22 (22), 6047-6065. [Zeng-Zhen HU, USA]	Will be assessed
14-464	14	22	36	22	36	not sure if salmon production is a topic of the IPCC report [Matthias Zahn, United Kingdom]	Agreed
14-465	14	22	48	22	48	Should probably refer to Ch. 9 Section 5.3 right away here and at least mention that the AMO is likely a coupled phenomenon but may also be driven by internal variability. Refer back to Chapter 2, Box 2.4 for a map of the AMO pattern and sign convention. [George Kiladis, USA]	Linkage to Ch2 and Ch9 will be ensured
14-466	14	22	50	22	50	change "apparent" with "seen" [ANNALISA CHERCHI, Italy]	Agreed
14-467	14	22	52	22	54	<p>The AMO about 20 year quasi-periodicity observed in ice core records (Chylek et al 2011) and supported by a simplified ocean model (Frankcombe et al 2010).</p> <p>Chylek, P., C. Folland, H. Dijkstra, G. Lesins, and M. Dubey, 2011: Ice-core data evidence for a prominent near 20 year time-scale of the Atlantic Multidecadal Oscillation, Geophysical Research Letters, 38, L13704, doi:10.1029/2011GL047501 Frankcombe, L., A. von der Heydt, and H. Dijkstra, 2010: North Atlantic multidecadal variability: An investigation of dominant time scales, J. Clim., 23, 3626-3638, doi:10.1175/2010GCL13471.1.</p> <p>[Petr Chylek, USA]</p>	Material will be assessed
14-468	14	22	52	22	54	<p>AMO variability is also seen on a c 20-25 year time scale. A recent paper shows a quasi- 20 year time scale in observations: Chylek, P., C.K. Folland, H. Dijkstra, G. Lesins, and M. K. Dubey, 2011: Ice-core data evidence for a prominent near 20 year time-scale of the Atlantic Multidecadal Oscillation. Geophys. Res. Lett., doi:10.1029/2011GL047501. A slightly longer 25 year time scale is seen in HadCM3: Dong, B. and Sutton, R. T. (2005), Mechanism of Interdecadal Thermohaline Circulation Variability in a Coupled Ocean-Atmosphere GCM, J. Clim. 18, 1117-1135 and also seen in GFDL coupled models. Based on Dong et al, the physics of the c20-25 year time scale AMO may differ from that of the quasi 70 year time scale. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]</p>	Material will be assessed

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14-469	14	22	52			For a red noise process of length 150 years, it is expected that the largest oscillation will have a period of about 70 years – as the spectral power increases towards lower frequencies, and T/2 is the lowest resolvable frequency in a record of length T. The existence of this particular “oscillation” in the record tells us nothing about true periodicity – and therefore very little about predictability going forward. [Adam Monahan, Canada]	Noted. This will be addressed in the SOD
14-470	14	22		37		Combining the two comments above, we have "The PDO is closely linked to winter temperature and precipitation anomalies over North America", and the models "underestimate the PDO". Thus the models will underestimate any temperature or precipitation changes over North America. The comment about anthropogenic causes is a presumed non-sequitor. Furthermore, the selection of the "over the last 50 years" starts the times series during a cold PDO epoch and ends during a warm PDO (with the change occurring halfway through, in 1977), and any trend would be due to a half cycle of the PDO. This should be pointed out with ALL changes "over the last 50 years" in western North America. [Richard Keen, USA]	First part rejected. It is not only PDO that determines temperature variability or changes over North America. The second part is also rejected. We do not discuss anthropogenic origin in observed timeseries. We use observed changes to provide background information in order to be able to assess the robustness of model projections of future change.
14-471	14	23	7	23	8	Concerning the AMO observed in hurricane frequency ad a reference to: Chylek P., and G. Lesins 2008: Multidecadal variability of Atlantic hurricane activity: 1851-2007, Journal of Geophysical Research, 113, D22106, doi:10.1029/2008JD10036 [Petr Chylek, USA]	Material will be assessed and noted if appropriate
14-472	14	23	9	23	10	The reference of Rajeevan and Latha Sridhar (2008) (Inter-annual relationship between Atlantic Sea Surface Temperature anomalies and Indian summer monsoon, M. Rajeevan and Latha Sridhar, 2008, Geophysical Research Letters, doi 10.1029/2008GL036025) may be also included on the relationship between Indian monsoon and Atlantic SST). [Madhavan Nair RAJEEVAN, India]	Material will be assessed and noted if appropriate
14-473	14	23	14	23	16	The way this sentence is worded makes it sound as if there is a reason to believe that AMO variability may not extend into the future – and I am not aware of any reason to believe this. We know that both the atmosphere and ocean show natural variability on a broad range of timescales. I would recommend this sentence be rewritten accordingly. [Adam Monahan, Canada]	Acknowledged. The sentence will be restructured
14-474	14	23	28	23	30	As I have argued above, the instrumental record gives us no reason to expect that “typical” AMO phases will have durations of ~ 30 years. The data are insufficient to demonstrate the existence of a spectral peak, and to the best of my knowledge are more consistent with a red noise spectrum. [Adam Monahan, Canada]	Noted. This will be considered in the SOD
14-475	14	23	29	23	29	The AMO is a pattern and does not in itself "cool", but the current phase implies warmth. It would be better to say that the AMO pattern would be expected to go into its opposite phase based on past history. [George Kiladis, USA]	Agreed
14-476	14	23	30	23	34	What does future decline of AMO mean? Is it a shift towards its negative phase as part of the cycle, that means that the effect might be limited to the more near term future. I suggest to be more precise here. Link to chapter 11 would be very useful here. [Judith Periwitz, United States of America]	Agreed. Will make this more clear and linkages with Ch11 ensured.
14-477	14	23	31	23	31	Does "AMO decline" refer to the phase of the AMO or its activity? This and the previous statement highlight the need to better clarify sign conventions of the modes. [George Kiladis, USA]	Agreed. Will make this more clear
14-478	14	23	45	24	13	The Thompson et al (2010) paper, mentioned above, is relevant to the discussion of sections 14.2.5.2.3 and 14.2.5.2.4. Thus Baines and Folland (2007) (referenced) indicate worldwide rapid responses to the interhemispheric SST jump shown particularly clearly by Thompson et al. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Will be considered
14-479	14	23	48			The word "also" complicates understanding of this sentence in relation to the previous. [Ramon de Elia, Canada]	Editorial
14-480	14	23	51	23	55	Mann and Emanuel (2006) [Mann, M.E., Emanuel, K.A., Atlantic Hurricane Trends linked to Climate Change, Eos, 87, 24, 233-241, 2006] argued for an important role of aerosol forcing in observed Atlantic SST trends. That work should be acknowledged here. [Michael Mann, USA]	Acknowledges. The material will be assessed
14-481	14	24	5	24	7	The statement that "Analyses separating the AMO and climate change by statistical means, however, find a potentially larger fractional contribution of the AMO to the recent warming trend (DelSole et al., 2011; Wu et al., 2011b)." is disputed, at this conclusion is highly sensitive to how that separation is done. Studies by Trenberth [Trenberth, K. E., and D. J. Shea (2006), Atlantic hurricanes	Noted. We will consider this work in the SOD, but retain from making any actual attribution statement in this chapter. Ch14 is about future projections.

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						and natural variability in 2005, Geophys. Res. Lett., 33, L12704, doi:10.1029/2006GL026894] and Mann and Emanuel [2005] argue that efforts to impute temperature impacts based on simple linear detrending of SSTs suffer from a misidentification of forced variability (which is not linear in time) as internal variability. Please note this work which disputes the attribution of a large contribution of the AMO to hemispheric-mean temperature trends. [Michael Mann, USA]	
14-482	14	24	8	24	13	It is of course true that the AMO may offset the influence of anthropogenic warming for some decades while it is its cool phase – but it must also be emphasized that when it moves back into its warm phase, it will amplify these effects. [Adam Monahan, Canada]	Agreed
14-483	14	24	23	24	26	Remove paragraph, as it has been already writtent in previous section [ANNALISA CHERCHI, Italy]	Will be considered together with other sections.
14-484	14	24	24	24	25	What is the verb in this sentence? I suspect "shape", but try to rephrase the sentence, because it is very confusing. [Christian Reuten, Canada]	Reworded.
14-485	14	24	38	24	56	The previous two paragraphs discuss the mean state, consistent with the section title, but these two paragraphs start talking about variability related more to the IOD. The IOD has not been defined in this chapter yet, and it seems more logical to discuss the modes first, and work these paragraphs into the discussion of variability of the IOD in subsection 14.2.6.4. [George Kiladis, USA]	Will be considered in the revision. IOD has been defined elsewhere in the report (Ch 2 & 9), and it seems more logical to discuss the mean state change.
14-486	14	24	42			What means east (West)? review [Ibouraïma YABI, Benin]	Double checked: marine cloudiness decreased (increased) in the east (west).
14-487	14	24	43	24	43	remove sentence about maritime continent, why here? [ANNALISA CHERCHI, Italy]	This serves as evidence in support of decreased marine clouds in the eastern Indian Ocean.
14-488	14	24	49	24	51	Stowasser et al. (2009) also noted these changes, and suggested the role of air-sea interactions. Please consider referring to this. [H Annamalai, USA]	Reference included.
14-489	14	24		25		General comments on the Tropical Indian Ocean modes: this section is well-written. As suggested above, the authors need to provide a better balanced view rather than over-emphasizing. [H Annamalai, USA]	Extra care will be taken for a balanced discussion.
14-490	14	25	2			Why choose a and b instead of" right" and" left"? [Ibouraïma YABI, Benin]	We prefer (a, b, ...)
14-491	14	25	6	25	6	NAM/NAO, SAM, IOD and monsoon changes are also briefly covered in Chapter 9, cross references needed [George Kiladis, USA]	Cross-references made.
14-492	14	25	10	25	10	The IOD is defined in Chap. 2 Box 2.4 and a map is shown in Box 2.4 Fig. 2, although it is called the "DMI" there. This needs to be reconciled. [George Kiladis, USA]	Will be coordinated with Ch 2.
14-493	14	25	19	25	25	This is a very nice summary - however, a very recent study by Bin Wang and collaborators have a different view on the role of Indian Ocean on the western Pacific monsoon variability - Please consider including that view also. [H Annamalai, USA]	Will be considered in SOD but it is hard to include all the details and points of view in a brief overview of the mode.
14-494	14	25	19	25	25	Also, Annamalai et al. (2007, JC) suggested the role of IOB mode on circulation and rainfall anomalies over western Pacific and also circulation anomalies over the PNA region. [H Annamalai, USA]	Annamalai's results are for winter/early spring while we focus on summer when the IOB's climatic effect is strongest. It is impossible to include all the IOB studies.
14-495	14	25	19	25	40	Also, only one third of the coupled model hindcasts analyzed suggest the role of Indian Ocean on western Pacific monsoon (Chowdary et al.) - A balanced view is required and requested here. [H Annamalai, USA]	In fact, Chowdary et al. concluded that IOB is "influential on NW Pacific climate during JJA".
14-496	14	25	38	25	39	why? IIs ENSO that force IOB, not the reverse ... [ANNALISA CHERCHI, Italy]	To first order, ENSO forces IOB.
14-497	14	25	44	25	44	"he"? adjust caption [ANNALISA CHERCHI, Italy]	Corrected.
14-498	14	25	44	25	44	Figure 14.5 Caption: delete "he" before JAS(1) [Celeste Saulo, Argentina]	Corrected.
14-499	14	25	49	25	49	In section 14.2.6.4 following could be added "Peak positive phase of the dipole during autumn could suppress	Will be considered in SOD but it is hard to include all

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						the following summer monsoon activity over the Korea-Japan sector (Kripalani, et al., 2010) [Ramesh Kripalani, India]	the IOD studies.
14-500	14	26	10	26	11	remove "in amplitude" after "much" [ANNALISA CHERCHI, Italy]	Corrected.
14-501	14	26	20	26	20	I think this should read "may become strong at the negative phase" [George Kiladis, USA]	Corrected.
14-502	14	26	25			Why choose a and b instead of "right" and "left"? [Ibouraïma YABI, Benin]	Our preference.
14-503	14	26	30	26	30	the change of the mean state [Matthias Zahn, United Kingdom]	Corrected.
14-504	14	26	30	26	39	remove the whole paragraph, it contains information already written in previous paragraphs [ANNALISA CHERCHI, Italy]	It is the assessment statement for the section, a summary in IPCC uncertainty language.
14-505	14	26	41	29	10	Some of this discussion needs to be related to quasi-global scale SST patterns (and independently measured but similar night marine air temperature patterns) that contain the some of the tropical Atlantic patterns discussed by Folland et al (1999) and updated in Parker et al (2007). Thus Fig 14.7 (p102) is very likely just part of the global warming eigenvector (EOF)1 of both these papers as indicated by the time series of Fig 14.7. Fig 14.8 is probably part of the global AMO EOFs of both papers. Perhaps these more global patterns, and the global pattern of the IPO described above, should be shown as well, possibly being even more fundamental to the chapter? [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Ping, please consider a brief discussion about global SST patterns. This seems related to the next comment.
14-506	14	26	46	26	52	The discussion here also relates to Figure 14.7. The statement and figure are profoundly problematic. Apparently the AMO was simply defined here as the average over of the SST field over the North Atlantic. Well, that is no AMO whatsoever. That is simply a North Atlantic SST average. Near as I can tell, the only thing that this comparison shows is that the PC of the leading pattern of SST looks like the time series of the mean of the SST field--that is nearly a tautology. The "AMO" has typically been defined in terms of a residual pattern of SST once the linear trend has been removed (though even that is quite problematic as shown by Mann & Emanuel 2006 and Trenberth & Shea 2006). That reflects an attempt to remove (crudely) the forced long-term warming, and therefore precludes explaining or resolving any long-term warming trend. But here apparently even that has not been done, so that what we're looking at is by construction the sum of the forced and internal variability component of North Atlantic temperature change over the past century. In other words, it is not by any reasonable definition "the AMO". Having coined the AMO in the first place, I take this quite seriously. [Michael Mann, USA]	Revision will use a detrended AMO index. No attempts are made here, though, to decompose tropical Atlantic warming into the forced response and internal variability.
14-507	14	26	47	26	47	In Figures 14.7 and 14.8 captions "annual values" should be specified (if that is what they are) [George Kiladis, USA]	Based on monthly mean values, now stated in text
14-508	14	26	51	26	52	correlations should be given as 0.89 and 0.70 [George Kiladis, USA]	Corrected.
14-509	14	26		29		The three EOF patterns of tropical Atlantic variability are broadly consistent with patterns associated with spatially autocorrelated red noise and *no* real coherent large-scale structures – the first is a “monopole”, the second a “dipole”, and the third is a “tripole”. These patterns illustrate precisely the kind of pitfall that over-interpretation of EOFs can result in. These patterns may be associated with physically distinct modes, but the simplest null hypothesis is that they result from SST variability that is locally correlated but has no large-scale structure. This issue is discussed in Monahan et al. 2009 (cited in the Ch. 14 references), and in the references it cites. Fully 2.5 pages of this chapter are devoted to these “modes” - the caveats associated with their physical interpretation really should be acknowledged. [Adam Monahan, Canada]	Ambiguity of EOF decomposition will be discussed briefly in the revision. Studies of ocean-atmosphere interaction for the past two decades show that the equatorial mode is due to Bjerknes feedback, and the meridional mode to WES feedback. Thus the discussion of modes here is not solely based on EOF analysis but builds on a large body of work (some cited in the text) exploring ocean-atmospheric feedback that supports these modes.
14-510	14	27	1	27	1	As I've already pointed out for Chapter 9, I suggest using, whenever possible, the data sets presented in Chapter 2. Figure 14.7 is constructed with HadSST1 instead of HadSST3 [Celeste Saulo, Argentina]	Will be considered
14-511	14	27	7			"Majority of the models ..." should be "A majority of the models ..." [Adam Monahan, Canada]	Corrected.
14-512	14	27	9	27	9	insert "At least half the observed trend in the interhemispheric SST gradient may be attributed to 20th century climate forcing (Chang et al., 2011)." before "However" [ANNALISA CHERCHI, Italy]	Reorganized.

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14-513	14	27	13	27	13	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Anthropogenic aerosol cooling effects are well established in literature.
14-514	14	27	14	27	17	Remove sentence [ANNALISA CHERCHI, Italy]	Done.
14-515	14	27	25	27	25	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Anthropogenic increase in aerosols is well established in literature.
14-516	14	27	30	27	30	Atlantic Meridional Mode [George Kiladis, USA]	Done.
14-517	14	27	32	29	4	sections 14.2.7.2 and 14.2.7.3 are exactly same. [Zeng-Zhen HU, USA]	It was a compiling error. Corrected.
14-518	14	27	37	27	38	may cite following paper here: [Zeng-Zhen HU, USA]	Will be considered but it is hard to include all the TAV studies.
14-519	14	27	37	27	38	Hu, Z.-Z. and B. Huang, 2006: Physical processes associated with tropical Atlantic SST meridional gradient. J. Climate, 19(21), 5500-5518. [Zeng-Zhen HU, USA]	Will be considered but it is hard to include all the TAV studies.
14-520	14	27	40	27	40	may cite following paper here: [Zeng-Zhen HU, USA]	Will be considered but it is hard to include all the TAV studies.
14-521	14	27	40	27	40	Hu, Z.-Z., A. Kumar, B. Huang, Y. Xue, W. Wang, and B. Jha, 2011: Persistent atmospheric and oceanic anomalies in the North Atlantic from Summer 2009 to Summer 2010. J. Climate, 24(22), 5812-5830, DOI: 10.1175/2011JCLI4213.1. [Zeng-Zhen HU, USA]	This is an interesting case study and included in the revision.
14-522	14	28	16	28	16	Same comment as before (#67) [Celeste Saulo, Argentina]	Seems to refer to comment 14-510 about using HadSST3. Will be considered.
14-523	14	28	22	29	4	This entire section is a repetition of section 14.2.7.2 from page 27, line 30 to page 28, line 13. Since this section is followed by a different figure, I suspect that there was supposed to be a different text that explains the 3rd EOF. [Christian Reuten, Canada]	It was a compiling error. Corrected.
14-524	14	28	24	29	4	remove, it is a repetition of "Meridional mode" and "Atlantic Nino" is missing [ANNALISA CHERCHI, Italy]	It was a compiling error. Corrected.
14-525	14	28	24	29	4	This section is of course incorrect – it's simply a repetition of the previous section. [Adam Monahan, Canada]	It was a compiling error. Corrected.
14-526	14	28	24	29	4	These paragraphs are duplicated from the previous section. So section 14.2.7.3 has no text and Fig. 14.9 (third EOF) is not discussed. [Celeste Saulo, Argentina]	It was a compiling error. Corrected.
14-527	14	28	25	28	25	3rd EOF [George Kiladis, USA]	It was a compiling error. Corrected.
14-528	14	28	35	28	35	Fig. 14.9 caption says 3rd EOF [George Kiladis, USA]	It was a compiling error. Corrected.
14-529	14	28	54	28	57	Repeats what was already said above [George Kiladis, USA]	It was a compiling error. Corrected.
14-530	14	29	7	29	7	Same comment as before (#67) [Celeste Saulo, Argentina]	Seems to refer to comment 14-510 about using HadSST3. Will be considered.
14-531	14	29	16	29	16	PNA and PSA discussed in Chapter 9, maps shown in Chapter 2 Box 2.4, cross reference needed [George Kiladis, USA]	Accepted. Will cross-reference with Chapters 2 and 9.
14-532	14	29	16	29	17	The PNA as defined by Wallace & Gutzler was defined by a correlation-based teleconnectivity – it wasn't based on "recurrence". Subsequent definitions typically involve some sort of eigenmode decomposition – which again aren't based on recurrence. [Adam Monahan, Canada]	Accepted. Will be more careful with usage of the word 'recurrence'
14-533	14	29	16	29	21	The authors should mention the meteorological parameter that the pattern is based on. [Christian Reuten, Canada]	Accepted. Will mention the parameter used to define the PNA pattern
14-534	14	29	28	29	37	It seems to me that this entire paragraph should be moved earlier to the section on ENSO teleconnections.	Taken into consideration. Section on ENSO

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						[Adam Monahan, Canada]	teleconnections (14.2.4.3) mainly deals with general concepts. The material cited in present paragraph contains more specific details. A sentence will be inserted in section on ENSO teleconnections to refer to the material here
14-535	14	29	35	29	37	A couple more studies that also reported a stratospheric link between ENSO and NAO: (1) Bell, C. J., L. J. Gray, A. J. Charlton-Perez, M. M. Joshi, A. A. Scaife, 2009: Stratospheric Communication of El Niño Teleconnections to European Winter. <i>J. Climate</i> , 22, 4083–4096. (2) Cagnazzo, C., and E. Manzini, 2009: Impact of the stratosphere on the winter tropospheric teleconnections between ENSO and the North Atlantic and European Region. <i>J. Climate</i> , 22, 1223–1238. [Alexey Karpechko, Finland]	Accepted. The two references will be added
14-536	14	29	36			Also suggest referencing Cagnazzo and Manzini 2009 <i>Clim Dyn</i> for ENSO-NAO link [Adam Scaife, United Kingdom of Great Britain & Northern Ireland]	Will do
14-537	14	29	53	29	53	Covering the South Pole I wonder what is meant by west Antarctic. [Matthias Zahn, United Kingdom]	Noted. Text changed to read "parts of the coastal west Antarctic."
14-538	14	29	57	29	57	which dipole? [ANNALISA CHERCHI, Italy]	Noted - changed to "precipitation dipole"
14-539	14	30	16	30	17	You mean that results will be updated before July 2012? Otherwise this sentence is true for all the section, and it can be removed from here [ANNALISA CHERCHI, Italy]	Noted - sentence removed.
14-540	14	30	17	30	17	"are being" [George Kiladis, USA]	Noted - sentence removed.
14-541	14	30	19	32	24	Arguably, the summer NAO should be mentioned separately here and distinguished physically from the winter NAO as in Folland et al (2009), already referenced. Hurrell et al, 2003 (already referenced) provide a linking discussion showing how the NAO pattern	Accepted. A sentence has now been added to make this clear and cite the mentioned references.
14-542	14	30	19	32	50	Please consider including some discussions/assessments on AO and note that NAO is only part of AO. Moreover, please consider addressing the possible impacts of the decline of Arctic sea ice cover on the atmospheric circulation, AO pattern and future cl	Rejected. This assessment has searched all articles on AO and NAM as well as NAO so this has already been covered.
14-543	14	30	28	30	28	references in chronological order [Matthias Zahn, United Kingdom]	Accepted.
14-544	14	30	30	30	31	Add:that influence climate over Europe, the N. Atlantic ocean "and North America" [Wanner Heinz, Switzerland]	Accepted.
14-545	14	30	30	31		Please add: "It is intimately related to the North Atlantic jet and storms AS WELL AS BLOCKING SYSTEMS that influence climate over Europe and the N. Atlantic ocean (Hurrell and Deser, 2009, SCHERRER ET AL, 2006). Scherrer, S. C.; Croci-Maspoli, M.; Schwi	Accepted.
14-546	14	30	33	30	33	"has been interpreted" [George Kiladis, USA]	Editorial. Accepted.
14-547	14	30	33	30	39	Given that the climate change pattern may differ over the Pacific (Karpechko, A. Y. and E. Manzini, 2011: Stratospheric influence on tropospheric climate change in the Northern Hemisphere. <i>J. Geophys. Res.</i> , in press), this grouping is not justifiable. My r	Rejected. The NAO and AO indices have been highly correlated with one another in the past and there is no strong evidence that this will change much due to future climate change so we prefer to treat them together. We have added a comment about AO being used to refer to surface NAM.
14-548	14	30	35	30	35	one particular NAO index was defined in Chapter 2 Box 2.4 Table 1. The index referred to here should be specified since this becomes relevant later [George Kiladis, USA]	Accepted. We now refer to the NAO index defined in Chapter 2.
14-549	14	30	56	31	1	the following statement is incorrect: "For example, one study found no significant NAO trends in two simulations with ECHAM4/OPYC3 (Fischer-Bruns et al., 2009)". Using ECHAM4/OPYC3 simulations, Ulbrich and Christoph (1999) and Hu and Wu (2004) found a sig	Accepted. This point about the shift has now been added.

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14-550	14	30	56	31	1	Ulbrich, U. and M. Christoph, 1999: A shift of the NAO and increasing storm track activity over Europe due to anthropogenic greenhouse gas forcing. <i>Clim. Dyn.</i> , 15, 551-559. [Zeng-Zhen HU, USA]	Noted. This paper is already cited.
14-551	14	30	56	31	1	Hu, Z.-Z. and Z. Wu, 2004: The intensification and shift of the annual North Atlantic Oscillation in a global warming scenario simulation. <i>Tellus</i> , 56A (2), 112-124 [Zeng-Zhen HU, USA]	Noted. This paper is already cited.
14-552	14	30	56	31	4	sentences that contrast results about agreement in models claimed 2 lines before. Insert better or remove [ANNALISA CHERCHI, Italy]	Accepted. The word "however" has now been added to clarify that this is a caveat of the earlier summaries.
14-553	14	31	4	31	4	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here as stated in the literature
14-554	14	31	6	31	14	An assessment of the way the reported investigations have defined and derived trends in NAO would be very useful. Did they use the same methodology? With respect to which climatology are the modes calculated? Past climatology? Slowly varying climatology?	Rejected. This is an important issue but due to page limits, this level of detail is not feasible in this assessment report but is explained in the cited publications.
14-555	14	31	10	31	12	How is the Hori et al. result distinct from the idea that change will project on the NAO mode? A shift in base state will project on NAO variability to produce a trend. [Adam Monahan, Canada]	Accepted. This has been reworded to make it clear that the NAO was defined after subtracting the mean state (and hence a shift in base state will not project on NAO defined this way).
14-556	14	31	12	31	12	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-557	14	31	13	31	13	To explain the "coupling" here would be of interest. This sentence as is now is vague, and does not give much of a clue of the type of the relationship of interest. [Elisa Manzini, Germany]	Accepted. This point has been expanded slightly to make it more informative.
14-558	14	31	17	31	17	Ulbrich and Christoph (1999) and Hu and Wu (2004) examined the NAO pattern shift in ECHAM4/OPYC3 simulations. And should be cited here. [Zeng-Zhen HU, USA]	Accepted. References now added.
14-559	14	31	17	31	17	references in chronological order [Matthias Zahn, United Kingdom]	Editorial
14-560	14	31	26	31	26	What is exactly meant by trend in a mode of variability? With respect to which mean? [Elisa Manzini, Germany]	Accepted. This is now defined explicitly by writing "trends in NAO indices" which would generally be interpreted as smooth long-term changes in the mean.
14-561	14	31	28	31	28	sentence is in contrast with line 51 of previous page [ANNALISA CHERCHI, Italy]	Rejected. There is not a contradiction - the models get a positive sign generally but underestimate the magnitude of the response.
14-562	14	31	35	31	35	"negative NAO winters" out of context unless defined as previously noted [George Kiladis, USA]	Accepted. Reference now made to specific winters in Chapter 2's NAO index.
14-563	14	31	35	31	36	references in chronological order [Matthias Zahn, United Kingdom]	Accepted.
14-564	14	31	38	31	41	Although I do not question the possibility that changes in stratospheric water vapor may influence the NAO, I suggest toning down this statement because, due to the lack of observations, the changes in stratospheric water vapor since 1965 are quite uncert	Accepted. The sentence now mentions this caveat related to observational uncertainty in water vapour.
14-565	14	31	41	31	42	Karpechko and Manzini (2012) arrived to similar results as Scaife et al. (2011) and, additionally, provided more inside into how changes in the stratosphere are linked to tropospheric changes. Therefore I suggest referring to their study as well. Missing	Accepted. This paper is now also mentioned.
14-566	14	31	41	31	42	Do you mean "very likely". This statement is misleading. While I agree that stratospheric processes and thus the troposphere-stratosphere coupled system has to be considered for understanding NAO variability and change, we do not know at this point i	Accepted. We mean "possible" for the lack of current knowledge you mention.

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14-567	14	31	42	31	42	Scaife et al 2011 is an important work - however it is about mean climate changes - a signal to me of not well defined meaning of "simulating NAO trends" in this chapter. It would be very helpful an assesment of the methodologies used. [Elisa Manzini,	Accepted. This sentence has now been reworded to make this aspect clear.
14-568	14	31	42			Also suggest reference to Morgenstern et al 2010 for NAO-stratosphere link. As I can't seem to input it as a separate comment please also see p34 line 28: after "events" suggest "...and recent studies suggest that both high resolution (Matsueda 2009) and r	Accepted. These references have now been added.
14-569	14	31	44	31	47	The first two sentences in this paragraph are hard to reconcile. [Adam Monahan, Canada]	Accepted. These sentences have now been rewritten more carefully.
14-570	14	31	44		49	Solar cycle signal in NAO found by Haigh and Roscoe (Met Zeit 2006), consistent with Ineson et al. [Joanna Haigh, UK]	Accepted. This earlier reference now added.
14-571	14	31	47	31	47	"negative NAO" define above [George Kiladis, USA]	Accepted. We now refer to Chapter 2 where the NAO index is defined.
14-572	14	31	48	31	48	"Summertime NAO was found to be lower" i.e. more negative? [George Kiladis, USA]	Accepted. This has now been reworded more carefully.
14-573	14	31	51	31	52	This section should be expanded, as Arctic sea ice variation and reduction influences on atmospheric circulation is an important topic. The evidence, even if details remain unclear, for an influence of Arctic sea ice on winter extratropical NH atmospheric	Accepted. This paragraph has been expanded by adding the more recent of these references.
14-574	14	31	51	31	54	The modeling evidence of the impact of Arctic sea ice loss on the NAO is not robust (See also recent paper Blüthgen, J., R. Gerdes, and M. Werner (2012), Atmospheric response to the extreme Arctic sea ice conditions in 2007, Geophys. Res. Lett., 39, L02707	Accepted. These good points have now been added to the expanded paragraph on sea ice and NAO.
14-575	14	31	52	31	52	references in chronological order [Matthias Zahn, United Kingdom]	Accepted. Editorial.
14-576	14	32	6	32	7	Concerning the link between NAO and runoff over the Mediterranean, it would be nice to insert this paper, Struglia et al., 2004. "The North Atlantic Oscillation (NAO) impacts Mediterranean discharge primarily in winter, with most river discharges across t	Rejected. This chapter's assessment is on future regional climate change so we do not attempt to provide a comprehensive review of all of NAO's impacts in past climate.
14-577	14	32	11	32	11	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-578	14	32	12	32	13	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	The statement does not refer to the lines quoted
14-579	14	32	20	32	20	Recently, Hu et al. (2011) demonstrated that NAO, ENSO, and long-term trends are the major factors resulting in the record high SST in the Atlantic Main Hurrincance Development Region (MDR) in 2010 summer. [Zeng-Zhen HU, USA]	Rejected. This chapter's assessment is on future regional climate change so we do not attempt to provide a comprehensive review of all of NAO's impacts in past climate.
14-580	14	32	20	32	20	Hu, Z.-Z., A. Kumar, B. Huang, Y. Xue, W. Wang, and B. Jha, 2011: Persistent atmospheric and oceanic anomalies in the North Atlantic from Summer 2009 to Summer 2010. J. Climate, 24(22), 5812-5830, DOI: 10.1175/2011JCLI4213.1. [Zeng-Zhen HU, USA]	Rejected. This chapter's assessment is on future regional climate change so we do not attempt to provide a comprehensive review of all of NAO's impacts in past climate.
14-581	14	32	36	32	37	remove sentence about NPO [ANNALISA CHERCHI, Italy]	Accepted. Editorial.
14-582	14	33	1	33	1	Cross refer to Allan et al (2009) for autumn storms. Allan, R., S. Tett, and L. Alexander, 2009: Fluctuations in autumn-winter severe storms over the British Isles: 1920 to present. International Journal of Climatology, 29, 357-371. [Christopher Folland,	Accepted. This reference is now added.
14-583	14	33	4	34	7	Section 14.2.10: Jones, J. M. et al Historical SAM variability. Part I. Century-length seasonal reconstructions., 2009: J Climate, 22, 5319-5345 should be referred to [Christopher Folland, United Kingdom of Great Britain &	Incorporated, thanks.

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						Northern Ireland]	
14-584	14	33	6	33	6	SAM defined using Marshall's index in Chapter 2, Box 2.4 Table 1 [George Kiladis, USA]	Noted - Marshall index used in Figure.
14-585	14	33	6	33	25	Misses important papers and reference to chapter 10 and 11. papers suggested to cite are Fogt et al 2009, McLandress et al. 2011, Polvani et al. 2011. [Judith Perlwitz, United States of America]	Noted - text rewritten and cross-referenced to Ch 10, 11. Several new refernces added.
14-586	14	33	15			A specific study of the effects of the SAM/jet variation on the continents is Watterson I. G. (2009) Components of rainfall and temperature anomalies and change associated with modes of the Southern Hemisphere, Int. J. Climatol.,29, 809-826, DOI: 10.1002/joc.1772 [Ian Watterson, Australia]	Noted - reference and new material incorporated.
14-587	14	33	17		25	Role of GHGs, ozone, QBO and solar variability in temporal evolution of SAM diagnosed by Roscoe and Haigh (QJRMS, 2007) [Joanna Haigh, UK]	Noted, no change. Presently-cited references are adequate, and feel this paper assumes a (limited) linear relationship between ozone loss and climate forcings.
14-588	14	33	24	33	25	The results of Karpechko et al. (2010) support this statement and should be referred to here. They studied the response of the Southern Hemispheric circulation to expected future ozone and GHG changes. They reported that, in their simulations, future SLP trends in high-latitudes were consistent with ENSO-induced teleconnection patterns and were probably triggered by warming of the tropical SSTs. Missing reference: Karpechko, A. Y., N. P. Gillett, L. J. Gray, and M. Dall'Amico (2010), Influence of ozone recovery and greenhouse gas increases on Southern Hemisphere circulation, J. Geophys. Res., 115, D22117, doi:10.1029/2010JD014423. [Alexey Karpechko, Finland]	Noted, thanks. Incorporated this reference and modified the discussion accordingly.
14-589	14	33	28	33	28	The black line in Fig. 14.11 is not a trend line but a smoothed curve of the raw data. Specify how it was derived [George Kiladis, USA]	Noted. Caption changed to indicate the 2D plot is a regression map using the BAS/Marshall SAM index, and the black line in the time series is a heavily smoothed version of the seasonal SAM index (IPCC 13-point filter applied 7 times).
14-590	14	33	34	33	45	Reference to chapter 9 would be useful here. Recent model studies suggest that GHG and ozone effects will cancel each other out, thus trends will not reverse (Polvani et al 2011, McLandress, et al. 2011, see also Son et al. 2011 for general agreement between CCMVal version 2 models and AR4). Uncertainties of future change in SAM evolve from the rate of ozone recovery and rate of GHG increase. [Judith Perlwitz, United States of America]	Noted. Cross-reference to Ch 9 added.
14-591	14	33	40	33	41	A link/consistency check with corresponding section in Chap 9 is needed here [Eric Guilyardi, France]	Noted. Cross-reference to Ch 9 added.
14-592	14	33	40	33	44	This sentence is internally inconsistent. Contrary to what is stated in this sentence, the models assessed by Gerber et al. indicate no significant trends in SAM index during the 21 century, suggesting that the impact of ozone recovery has a comparable effect on the SAM to that of greenhouse gas increases, see Son et al. (2010). I think Son et al. (2010) is a better reference than Son et al. (2008) because there are more models included in the former study. Moreover, Polvani et al. (2011) report a cancellation of circulation trends during ozone recovery, also implying that future ozone and GHG changes have comparable effects on the SAM, rather than a dominance of ozone effects. Reference: Son, S.-W., et al. (2010), Impact of stratospheric ozone on Southern Hemisphere circulation change: A multimodel assessment, J. Geophys. Res., 115, D00M07, doi:10.1029/2010JD014271. [Alexey Karpechko, Finland]	The Gerber et al. reference is in relation to comparison with reanalyses. Perlwitz et al (2008) do find a reversal, and other references also point in this direction. Agree that Son et al (2010) is a good reference, have added, along with new paper by Bracegirdle et al.
14-593	14	33	43	43	33	"that is", [George Kiladis, USA]	Noted.
14-594	14	33	44	33	45	result coming from? which kind of model? coupled, chemistry? [ANNALISA CHERCHI, Italy]	CCMs, as noted in the text.
14-595	14	33	47	34	7	The discussion in this part is overall correct; however I feel that the inconstancy of the SAM-climate relationship is overstated. For example, my impression based on literature reading is that cooling effect of positive SAM phase on the Antarctic mainland, as well as its warming effect on the Antarctic Peninsula, is robust over large areas. I suggest specifying in the first sentence of this discussion that the uncertainty concerns only limited regions where the influence of SAM on climate is marginal anyway. Also I do not think	Have revised this paragraph to reflect that the potential unstationaries lead to uncertainty, whereas the seasonal variations need to be considered in impacts studies (which has been put in a separate paragraph).

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						that the seasonal dependence of the SAM-climate relationship, for example that one in Australia reported by Hendon et al. (2007), adds any uncertainty into future SAM impacts, as long as the seasonal dependence is well documented and understood. [Alexey Karpechko, Finland]	
14-596	14	33	51	33	55	Again – how is this apparent “non-stationarity” distinguished from sampling variability? [Adam Monahan, Canada]	Noted - sampling variability is always an issue in observational studies. Yet in this discussion of future impacts, bringing in the issue of decadal variability as we have is appropriate.
14-597	14	34	3	34	3	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-598	14	34	9	34	31	Blocking is also discussed in Sections 2.6.6.3 and 9.5.2.2. Cross referencing needed [George Kiladis, USA]	Noted - cross-references added.
14-599	14	34	9			Please consider including the findings of the study of Park et al. (2011). They found that blocking is also associated with intense cold weather in East Asia and is related to AO. Reference : Park T., C. Ho, S. Yang, 2011: Relationship between the Arctic Oscillation and Cold Surges over East Asia. J. Climate, 24, 68-83. [Tsz-cheung Lee, Hong Kong]	Noted.
14-600	14	34	9			This section on blocking signature and impact on regional scale should consider few more aspects. Specifically, summer blocking and blocking signature over the Antarctica. 1) The 2010 summer heat wave in western Russia was related to long-lived blocking event (Dole et al., 2011). The Russian summer heat wave was exceptional, with the warmest July since 1880. Russia's extreme surface temperatures were coincident with summer Euro-Asian atmospheric blocking. REFERENCE Dole, R, M Hoerling, J Perlwitz, J Eischeid, P Pegion, T Zhang, XW Quan, T Xu, and D Murray, 2011: Was there a basis for anticipating the 2010 Russian heat wave? GRL, VOL. 38, L06702, doi:10.1029/2010GL046582. 2) Snow precipitation is the primary mass input to the Antarctic ice sheet and is one of the most direct climatic indicators, with important implications for paleoclimatic reconstruction from ice cores. Blocking conditions occur in relationship with snowfall in Antarctica. REFERENCE Scarchilli, C, Frezzotti, M, PM Ruti, 2011 Snow precipitation at four ice core sites in East Antarctica: provenance, seasonality and blocking factors Clim. Dyn. doi:10.1007/s00382-010-0946-4 [Paolo Michele Ruti, Italy]	Noted. Dole et al (2011) already referenced. Will add a sentence on the Antarctic.
14-601	14	34	20	34	20	This sentence does not make good English sense for the North Atlantic or the Pacific - expand considerably. For example, the negative phase of the NAO is generally associated with blocking in the North Atlantic region though the blocking may be in different places to give this result. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Noted, text modified.
14-602	14	34	20			Please add following reference to: “In the NH NAO phase relates to preferred Atlantic blocking location (Luo et al., 2010, SCHERRER ET AL; 2006) Scherrer, S. C.; Croci-Maspoli, M.; Schwierz, C. & Appenzeller, C. (2006), 'Two-dimensional indices of atmospheric blocking and their statistical relationship with winter climate patterns in the Euro-Atlantic region', International Journal of Climatology 26(2), 233-249. [Christof Appenzeller, Switzerland]	Noted, text in this paragraph modified.
14-603	14	34	21	34	21	After “2008”, add: “Huang et al., 2006”, Reference: Huang J., M. Ji, K. Higuchi, and A. Shabbar, 2006: Temporal structure of North Atlantic Oscillation and its impacts on the regional climate variability, Advances in Atmospheric Sciences, 23(1), 23-32. [Jianping Huang, China]	Noted, text not changed. Not especially relevant to section on blocking.
14-604	14	34	21	34	21	"positive PNA" refer back to Chapter 2, Box 2.4 for definition [George Kiladis, USA]	Will ensure chapter makes cross reference, and makes polaiity clear, but this sentence unchanged.
14-605	14	34	25			Please add the following reference: “How the location and frequency of occurrence of blocking events evolves in future is critically important for understanding regional climate change (Buehler et al., 2011, SILLMANN ET AL, 2011). Sillmann, Jana, Mischa Croci-Maspoli, Malaak Kallache, Richard W. Katz, 2011: Extreme Cold Winter Temperatures in Europe under the Influence of North Atlantic Atmospheric Blocking. J. Climate, 24, 5899–5913.	Noted, reference added.

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						[Christof Appenzeller, Switzerland]	
14-606	14	34	29	34	29	Matsueda et al. (2009, JGR: already in the reference list) should be included here. [Shoji Kusunoki, Japan]	Matsueda (2009) not in current reference list.
14-607	14	34	30	34	31	Matsueda et al. (2009, JGR: already in the ref. list) and Matsueda et al. (2010, GRL: already in the ref. list) show that very high resolution models well simulate the frequency of blocking as mentioned in Page 9-43, and hereby give us a reliable future change in the frequency of blocking. These paper should be referred here. [Shoji Kusunoki, Japan]	Noted, text modified.
14-608	14	34	31	34	31	change "about as likely as not" with "totally uncertain" [ANNALISA CHERCHI, Italy]	Noted, text not changed. This is standard IPCC undertainty terminology.
14-609	14	34	31	34	31	However, there are new results quite strongly suggesting that modelled blocking can soon be greatly improved in the North Atlantic at least: Scaife, A.A., D. Copsey, C. Gordon, C. Harris, T. Hinton, S.J. Keeley, A. O'Neill, M. Roberts and K. Williams, Improved Atlantic Blocking in a Climate Model., 2011: Geophys. Res. Lett., 38, L23703, doi:10.1029/2011GL049573. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Noted, text modified.
14-610	14	34	34			The global 'hypermodes' of Dommenges D. and M. Latif (2008), Geophys. Res. Lett. v35, L02706, doi:10.1029/2007GL031087, warrant consideration. In a similar vein, changes in the Indian and Pacific ocean, together, have been considered by Watterson I. G. (2011) Understanding and partitioning future climates for Australian regions from CMIP3 using ocean warming indices. Climatic Change, doi:10.1007/s10584-011-0166-x. [Ian Watterson, Australia]	Material will be assessed to the degree it adds information to the regional changes
14-611	14	34	37	34	37	title should be "Regional Climate Change" [ANNALISA CHERCHI, Italy]	Structure has been revised
14-612	14	34	37	55	57	What actually happens is only incomplete and the emphasis is on the extent to which past behaviour can justify the, "projections". But will you change them if they are wrong?.. [VINCENT GRAY, NEW ZEALAND]	If the projections are assessed to be wrong, this will be reflected in the statements made.
14-613	14	34	39			14.3.1.1 title is rather odd. [Ramon de Elia, Canada]	Agreed - has been changed
14-614	14	34	53	34	53	It makes much more sense to me to include Table 14.1 in Annex 1 instead of here, especially since this table is apparently never referred to again in this chapter [George Kiladis, USA]	The table will remain here, as it will also be referred to as part of overall assessments of regional change
14-615	14	35	1	35	3	The three key processes affecting regional climate were mentioned earlier. Besides the key processes and "as yet unidentified phenomena", there are local processes on small scales that have non-linear responses to larger-scale processes and environmental conditions, for example albedo feedback mechanisms in regions with winter snow cover, vertical heat transport processes in steep complex terrain, and moisture feedback mechanisms via soil moisture and vegetation. Modelling these processes in current GCM is very challenging, but we can certainly identify them. Furthermore, the identified changes on a global scale also imply regional changes. So referring back to an earlier comment, these truly local processes and global changes should be included in the list of key processes on page 9. [Christian Reuten, Canada]	the scale issue will be addressed better - will consider to mention local processes more specifically in the introductory parts
14-616	14	35	1			I like the point saying that this chapter is missing information on evapotranspiration, which has importance for hydrologic impacts. A problem that arises from this is that many impacts researchers will not realize that this information is there and available from climate models, assume that air temperature causes evapotranspiration rather than a more complex and realistic set of processes, and use temperature proxy methods to approximate ET that are calibrated for historical periods but not appropriate for climate change scenarios. [Brent Lofgren, USA]	Noted. We will try to include information about P-E, where this may seem more relevant than simply precip.
14-617	14	35	4	35	6	unclear: downscaled infos are taken into account or they are not? [ANNALISA CHERCHI, Italy]	Sentence will be reformulated
14-618	14	35	10	35	10	how can the future be observed? [ANNALISA CHERCHI, Italy]	Reformulated
14-619	14	35	12	35	25	not clear meaning of this paragraph: you are using outputs from global models, right? [ANNALISA CHERCHI, Italy]	We will consider reformulating this section
14-620	14	35	22			Account also for the case when regional climate is studied without any kind of cascade of models. [Ramon de	Agreed

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						Elia, Canada]	
14-621	14	35	28	35	41	About Table 14.1: Acronyms should be expanded (notes in the bottom?) What does "T YRS" represents? The probability should be described in the text, and not only referred to a 2007 paper. Definition of regions is found also in Annex I, right? [ANNALISA CHERCHI, Italy]	Will be completed and updated
14-622	14	35	43	36	46	Section 14.3.2: Chylek et al (2009) and (2010) suggest that Arctic temperature and climate may be influenced by fluctuations in the AMO:Chylek, P. Folland C.K., Lesins G., Dubey M., and M. Wang, 2009: Arctic air temperature change amplification and the Atlantic Multidecadal Oscillation. Geophys Res. Lett., 36, doi 10.1029/2009GL038777. Chylek, P., C K. Folland, G. Lesins and M K. Dubey, 2010: The 20th Century bipolar seesaw of the Arctic and Antarctic surface air temperatures. Geophys. Res. Lett. 37, L08703, doi:10.1029/2010GL042793. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	These references have been noted and included in the revised version.
14-623	14	35	45	36	46	this section duplicates some information from Chapter 5, and nearly all of the points within this section are covered in Chapters 2, 9, 10, and 11. Consider deleting this section or consolidating the information from other chapters into one place to save space here or elsewhere. [George Kiladis, USA]	The information in the other chapters will be cross-referenced against the content here and condensed where necessary.
14-624	14	35	51	35	51	being positively correlated [Matthias Zahn, United Kingdom]	the word also has been deleted as suggested
14-625	14	35	55	35	55	what do you mean with "Arctic-centric analyses"? Is that based on local data? Please explain [ANNALISA CHERCHI, Italy]	The wording has been changed to "Other more analyses more confined to the Arctic..."
14-626	14	36	5	36	5	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-627	14	36	14	36	14	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-628	14	36	15	36	15	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-629	14	36	15			"anthropogenic forcing" [Christian Reuten, Canada]	Will consider where appropriate
14-630	14	36	17	37	17	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Does not occur in the line quoted
14-631	14	36	19	36	19	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-632	14	36	20	36	20	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Does not occur in the line quoted
14-633	14	36	24	37	24	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-634	14	36	30	37	30	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-635	14	36	32	36	32	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-636	14	36	48			ENSO has a profound influence on N American regional climate. Why is completely absent from section 14.3.3? [David Sauchyn, Canada]	see response to comment below.
14-637	14	36	50	36	51	This list of climate phenomena affecting North America does not mention ENSO. But ENSO-related shifts in the Pacific storm track in winter-spring profoundly affect North American climate. Is this a matter of semantics - i.e. you intend to incorporate the effects of ENSO on North American through ENSO's influence on the stated modes of variability (as implied on page 37)?If so, it seems odd to include PDO as a direct influence on North America but not ENSO. [David Gutzler, USA]	ENSO has been added to the list of phenomena that affect N America, and a sentence has been added in the first paragraph: "The PNA can also be excited by ENSO-related SST anomalies, providing a link between ENSO and N. American climate."

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14-638	14	36	51	36	51	The North American monsoon was abbreviated "NAMS" earlier in this chapter, instead of "NoAM" here. I think "NAMS" is the more common acronym. [David Gutzler, USA]	The abbreviation has been changed to NAMS
14-639	14	36	51	36	53	Meaning of "positive" NAO and PNA should be defined somewhere earlier in the chapter [George Kiladis, USA]	Agreed. This is something we will sort out as an author team.
14-640	14	36	57	36	57	please add "Hu and Huang 2009" [Zeng-Zhen HU, USA]	see response to comment below.
14-641	14	36	57	36	57	Hu, Z.-Z. and B. Huang, 2009: Interferential impact of ENSO and PDO on dry and wet conditions in the U. S. Great Plains. J. Climate, 22 (22), 6047-6065. [Zeng-Zhen HU, USA]	This reference has been added
14-642	14	36	57			This paragraph refers to seminal work on the PDO but from the 1990s. North Pacific climate oscillations have been the subject of a considerable amount of literature in the past 10 years, for example, Shabbar, et al. 2011. Atmospheric and oceanic variability associated with growing season droughts and pluvials on the Canadian Prairies. Atmosphere-Ocean; and Bonsal, B.R. and A. Shabbar. 2008. Impacts of large-scale circulation variability on low streamflows over Canada: A review. Canadian Water Resources Journal, 33, 137-154. [David Sauchyn, Canada]	The most recent of these papers is now cited.
14-643	14	37	6	37	6	cross reference Box 14.3 on tropical cyclones later in the chapter [George Kiladis, USA]	done
14-644	14	37	15	37	17	"Changes in the western North American snowpack over the last 50 years of the 20th century exceed model estimates of trends expected to occur by change due to internal variability alone (Pierce et al., 2008), indicating that anthropogenic changes in snowpack may already be underway." [Richard Keen, USA]	This comment is identical to what is in the text. However maybe the reviewer meant to indicate that the word "change" should be "chance". The text has been changed in this way.
14-645	14	37	17	37	17	Black carbon deposition is also a likely factor in snowpack trends and should be mentioned. A good reference is Qian, Y., W. I. Gustafson, L. R. Leung, and S. J. Ghan, 2009 J. Geophys. Res. 114, doi:10.1029/2008JD011039 [George Kiladis, USA]	the reference has been added and the text altered accordingly.
14-646	14	37	17			You probably should also cite Pederson, et al. 2011. The unusual nature of recent snowpack declines in the North American Cordillera. Science 333: 332-335. [David Sauchyn, Canada]	This is an excellent reference and is now noted and cited in the text.
14-647	14	37	18			This line says that changes in snowpack are difficult to assess using AR5 models. This seems to imply that this issue is new to the newest generation of models, and of course it isn't. [Brent Lofgren, USA]	A clause has been added to the beginning of this sentence: "As with the CMIP3 models..." to clarify this point.
14-648	14	37	26	37	26	refer to Box 14.4 here. [George Kiladis, USA]	done
14-649	14	37	30			Canada is a large country (2nd largest on earth) so this seems like a broad generalization. The substantial precipitation increase is more likely across northern Canada. [David Sauchyn, Canada]	This is something that will have to be confirmed when the atlas is complete and the precip projections can be referred to more explicitly.
14-650	14	37	33	37	33	I think the term project (rather than predict) is more suitable to characterize the IPCC model simulations. [Matthias Zahn, United Kingdom]	Agreed. This term has been changed throughout.
14-651	14	37	33	37	48	Seager et al. (Science, 2008) project a near-term future trend toward 'drying' (decreased P-E) across southwest North America based on CMIP3-simulated changes, and subsequent studies have extended their work. It is important to note that the trend they and others describe is not just, or even primarily, the result of decreased precipitation. I suggest assessing this body of work, as it represents a potentially profound regional change. [David Gutzler, USA]	This paper is now cited, and the text now distinguishes between precipitation changes and hydroclimate change driven by changes in the P-E balance.
14-652	14	37	37	37	37	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-653	14	37	40	37	40	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-654	14	37	41	37	41	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here

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14-655	14	37	44	37	44	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-656	14	37	47	37	47	cross reference back to Chapter 9.5.3.4.1 and Chapter 10.3.3.2 needed [George Kiladis, USA]	Needs a general double check with revisions
14-657	14	37	47	37	47	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-658	14	37	48			Cite also Lapp et al. 2011 GCM projections for the Pacific Decadal Oscillation under greenhouse forcing for the early 21st century. This recent paper is cited elsewhere in AR5 where GCM simulations of Pacific SSTs are assessed. [David Sauchyn, Canada]	This paper is already cited in this chapter in the context of an assessment of the PDO. Since the paper is really about the PDO, not N America, this seems like the most appropriate place to cite it, rather than in the N. America section.
14-659	14	37	50	37	50	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-660	14	37	50	38	6	Also covered in Section 14.2.2.6, consider merging [George Kiladis, USA]	The boundary between what is covered in 14.2.2.6 and here will be sharpened for the TOD.
14-661	14	37	52			"Supply of water vapor" is a problematic description, and needs to be clarified. Taking this literally, I assume this means the amount of water vapor flux going into the atmosphere. But taken in context, it seems to be the amount of water resident in the atmosphere (i.e.precipitable water). [Brent Lofgren, USA]	It has been changed to " atmospheric convergence of water vapor in the region", though this text will also be revisited when the atlas matures.
14-662	14	37	54	37	54	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-663	14	37	57	38	1	The "core" North American monsoon area is northwest Mexico, not in the US as stated (I made the same comment in reference to the same statement on page 16.) [David Gutzler, USA]	Yes, this is an error, and has been corrected.
14-664	14	38	3	38	3	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-665	14	38	28	38	30	the exact relationship between easterly wave activity and precipitation should be specified. [George Kiladis, USA]	taken into account-As the CLLJ becomes stronger than around 15 m/s, easterly wave activity decreases (see Méndez and Magaña 2010)
14-666	14	38	30	38	32	refer back to 14.2.3.1 [George Kiladis, USA]	rejected-The sentence he refers to is about the effect of the warm pool on the low-level jet — when the WHWP is large (warm) the jet is weak. Kiladis refers back to section 14.2.3.1 but that section (on the ITCZ) has three comments by him and it's not clear how they apply to our sentence. In those comments he is referring to a meridional shift in the ITCZ due to SST changes to the north or south of the ITCZ. Is he saying the jet is weakened because the ITCZ is shifted northward and that we should point this out? If so, then I do not agree. The jet is weakened because the NASH is weakened, not because the ITCZ moves a few degrees north.
14-667	14	38	33	38	36	"the shear...affect hurricane" in what way? This should be specified. [George Kiladis, USA]	accepted- new text included: "The decreased shear and increased relative humidity above the warm pool both favor the intensification of tropical cyclones transiting the region enroute to landfalls in the Caribbean, Central America and the US."

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14-668	14	38	35	38	35	"Gill atmosphere" this term is meaningless unless expanded upon. This is probably too speculative anyway and should be removed. [George Kiladis, USA]	taken into account. The text was changed to: "Model experiments and atmospheric reanalysis data suggest that these warm pool impacts are related to the formation counter-rotating circulation anomalies at low and high levels of the troposphere overlying the warm pool (Wang et al. (2008). Such circulation anomalies are consistent with the atmospheric response to an off-equatorial SST anomaly as described by Gill (1980)." (Gill, A. E., 1980: Some simple solutions for heat-induced tropical circulation. Quart. J. Roy. Meteor. Soc., 106, 447–462.)
14-669	14	38	38	38	39	Suggest saying something like: "Most of the CMIP3 projection over the Atlantic sector from AR4 are inconsistent with what might be expected in terms of local SST forcing" [George Kiladis, USA]	accepted- Changed to: Most of the CMIP3 projections over the Atlantic sector from AR4 are inconsistent with what might be expected in terms of local SST forcing."
14-670	14	38	39	38	39	change "don't make sense" with "are not realistic" [ANNALISA CHERCHI, Italy]	accepted- the sentence was changed to: Most of the CMIP3 projections over the Atlantic sector from AR4 are inconsistent with what might be expected in terms of local SST forcing."
14-671	14	38	40	38	40	expand TNA acronym [ANNALISA CHERCHI, Italy]	accepted- included: over the tropical North Atlantic (TNA)
14-672	14	38	40			I believe the acronym "TNA" has not been introduced at this point. [Christian Reuten, Canada]	accepted- it was included: tropical North Atlantic
14-673	14	38	56	38	57	Something got broken at the end of the sentence. [Christian Reuten, Canada]	taken into account- It was fixed: Most downscaled versions of the GCMs project decreases in precipitation over most of Mexico but only a few have considered the role of key elements that result in regional climate Mesoamerica and the Caribbean, such as easterly wave activity, tropical cyclones or other mesoscale phenomena, or interannual variability mechanisms associated with ENSO (Karmalkar et al., 2011).
14-674	14	39	2	41	6	Grammar, style, capitalizations, and punctuation of the entire section need to be improved. [Christian Reuten, Canada]	accepted. They will be corrected.
14-675	14	39	5	39	5	insert "Oceans" before "have a role" [ANNALISA CHERCHI, Italy]	rejected- The meaning here is the role of the blocking conditions, stationary waves and storm tracks on South America climate variability. Thus, we can not insert ocean before "have a role"
14-676	14	39	18	39	23	Observed changes in ENSO also covered in Chapter 2, cross reference back to Chapter 9.5.3.4.1 and Chapter 10.3.3.2 needed [George Kiladis, USA]	accepted. We will include the cross references.
14-677	14	39	20	39	20	do you mean increase in ENSO events? [ANNALISA CHERCHI, Italy]	taken into account- yes, increase of ENSO events.
14-678	14	39	21	39	21	anthropogenic The term should never be used in this context, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-679	14	39	21	39	23	A study with other model (ECHAM5-OM) indicates that the ENSO connection with southeastern South America could weaken in the projected future climate (Grimm and Natori, 2006; Grimm, 2011). Grimm, A. M. e A. A. Natori, 2006: Climate change and interannual variability of precipitation in South America. Geophys. Res. Lett., 33, L19706, doi:10.1029/2006GL026821.	taken into account- although it was required to not rely in a unique model.

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						Grimm, A. M., 2011: Interannual climate variability in South America: impacts on seasonal precipitation, extreme events and possible effects of climate change. Stochastic Environmental Research and Risk Assessment. v. 25, n. 4, 537-554, DOI: 10.1007/s00477-010-0420-1 [Alice Grimm, Brazil]	
14-680	14	39	35	39	35	insert "Thompson and Wallace, 2000" among the references in parentheses. The reference is "Thompson D, Wallace J (2000) Annular modes in the extra-tropical circulation. Part I: Month-to-month variability. J Clim 13: 1000-1016" [ANNALISA CHERCHI, Italy]	rejected- Here the references are related to the influence of the SAM on South America, not on the SAM itself. We mentioned the suggested reference in another part.
14-681	14	40	5	40	5	insert "season" after "Monsoon" [ANNALISA CHERCHI, Italy]	accepted.
14-682	14	40	18	40	18	insert "LPB has been recognized as a system sensitive to climate variability and change because of potential consequences for water resources and agriculture activity over the region (CLIVAR Exchanges 2011)." after "continent". The reference is "CLIVAR Exchanges "Special issue on LPB" no 57 Vol 16(3) October 2011 [ANNALISA CHERCHI, Italy]	accepted- It was included.
14-683	14	40	19	40	19	mesoescale => mesoscale [Matthias Zahn, United Kingdom]	editorial
14-684	14	40	20	40	21	"Higher frequency of LLJ" what does this mean? [George Kiladis, USA]	taken into account-Higher frequency of LLJ in the future projections in relation to the present frequency. (The number of days with presence of LLJ). We will include : in relation to the present frequency
14-685	14	40	25	40	25	Add at the end of the paragraph: "The continental scales modes of rainfall interdecadal variability is connected with global modes of SST, like IPO and AMO, and with regional SST modes (see Grimm and Ambrizzi, 2009 for a review on the atmospheric teleconnection link to LPB hydroclimate). After mid70s, La Nina events have a stronger impact on precipitation over LPB (Casez-Boezio and Talento, 2011), with warmer SST conditions in the Indian Ocean explaining a large portion of the associated upper level atmospheric circulation differences." The references are "Grimm A and Ambrizzi T (2009) Teleconnections into South America from the tropics and extra-tropics on interannual and intraseasonal timescales. In: "Past climate variability in South America and surrounding regions: From the Last Glacial Maximum to the Holocene", Vimeaux F, Sylvestre F, Khodri M eds, Springer, Chap 7, pp 159-193" and "Casez-Boezio G, Talento S (2011) La Nina events before and after 1979 and their impact on southeastern South America in summer. The role of the Indian Ocean. Int J Climatol (submitted) [ANNALISA CHERCHI, Italy]	rejected/ Taken into account- In this chapter we are not mentioning observed Interdecadal variability. This should be mentioned in chapter 5 or 11. We will include the reference about the role of Indian Ocean when it is published.
14-686	14	40	46			What's "PRECIS"? [Christian Reuten, Canada]	taken into account- PRECIS: Providing Regional Climates for Impacts Studies. We included the definition and changed the sentence:
14-687	14	41	6	41	6	Insert the following sentence after line 6; Ensemble projections by 20-km and 60-km mesh AGCM show increase of precipitation intensity almost all over South America, especially in the southeast South America in the end of 21st century (Kitoh et al, 2011). At the same time a large increase of consecutive dry days is projected over the western part of the Amazon, [Shoji Kusunoki, Japan]	accepted- Included: Ensemble projections with 20-km and 60-km mesh MRI AGCM show increase of precipitation intensity almost all over South America, especially in the southeast and North South America at the end of 21st century (Kitoh et al, 2011). At the same time a large increase of consecutive dry days is projected over the western part of the Amazon and Central Brazil
14-688	14	41	8	41	8	"Sectors" or "regions" should be included at the end of the title [ANNALISA CHERCHI, Italy]	Heading will possibly be modified
14-689	14	41	8	41	51	A new paper that discusses recent evidence about the various influences on Northern European winter climate, and provides some quantification is: Folland, C.K, Scaife, A.A., Lindesay, J. and D.B. Stevenson, 2011: How potentially predictable is northern European winter climate a season ahead? Int. J. Climatol. DOI: 10.1002/joc.2314 (on line) [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Will consider the paper
14-690	14	41	8	43	57	It has to be clearly emphasized that the division into "European and Mediterranean" for the whole European	Taken into account. This subsection will be entirely

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						continent is totally misleading and wrong. According to the Unites Nations reports in 2011 (click e.g. "Northern Europe" under Wikipedia!) Northern Europe includes Scandinavia and, in some UN reports, also UK. Two classical divisions are valid: The first with "Northern Europe, Central Europe and Mediterranean", the second with "Northern Europe, Western Europe, Eastern Europe and Southern Europe". The Mediterranean section is too long. [Wanner Heinz, Switzerland]	rewritten
14-691	14	41	8			Should all discussions for Europe be linked with NAO, AMO etc. Or are other papers included as well? [Kirsti Jylhä, Finland]	Taken into account. This subsection will be entirely rewritten
14-692	14	41	8			Sect.14.3.6: A more even balance between the Northern Europe and Mediterranean sections should be achieved. The latter is unnecessarily lengthy in my view. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Taken into account. This subsection will be entirely rewritten
14-693	14	41	12	41	14	Here I would suggest to add also other low frequency phenomena such as Blocking. [Paolo Michele Ruti, Italy]	Will consider to add other phenomena
14-694	14	41	13	41	16	I think a stronger emphasis on "ambient" changes would be appropriate, since these dominate future anomalies in summer. Eg. "NAO is strongly related to both of these processes and hence has a profound influence on European climate, along with other modes such as ENSO, EAP, AMO etc. In summer ambient conditions are critical for setting the climate and its likely changes, with key processes including soil moisture and the land-sea temperature contrast." [David Rowell, United Kingdom of Great Britain & Northern Ireland]	The regional sections will now seek do this
14-695	14	41	15	41	15	for "ambient conditions" do you mean "local processes"? the second would be better to be used [ANNALISA CHERCHI, Italy]	The terminology will be made more clear
14-696	14	41	17			How about snow in Europe in the future? Or discussed only in Sec. 12? [Kirsti Jylhä, Finland]	This will be considered along the revisions
14-697	14	41	23	41	23	true for the whole 21st century? [ANNALISA CHERCHI, Italy]	This will be reassessed in making a better link with Chps 11 and 12
14-698	14	41	27			Please consider adding: Gregow, H., Ruosteenoja, K., Pimenoff, N. and Jylhä, K. (2011), Changes in the mean and extreme geostrophic wind speeds in Northern Europe until 2100 based on nine global climate models. International Journal of Climatology. doi: 10.1002/joc.2398. http://onlinelibrary.wiley.com/doi/10.1002/joc.2398/abstract [Kirsti Jylhä, Finland]	Will assess this paper
14-699	14	41	27			Please also consider: Gregow, H., Peltola, H., Laapas, M., Saku, S. & Venäläinen, A., 2011. Combined occurrence of wind, snow loading and soil frost with implications for risks to forestry in Finland under the current and changing climatic conditions. Silva Fennica 45(1), p. 35–54. http://www.metla.fi/silvafennica/full/sf45/sf451035.pdf [Kirsti Jylhä, Finland]	Will assess this paper
14-700	14	41	34	41	34	"weather types" of what? [ANNALISA CHERCHI, Italy]	weather type classification
14-701	14	41	38	41	46	The Precipitation (flooding and droughts) It is suggested to skip the reference to flooding and droughts as the descibed changes in percipitation may not lead to changes in the frequency or magnitude of floods and droughts and there are also a number of changes in precipitation and temperautre that may affect floods and droughts that are not described in this very short paragraph. [Hege Hisdal, Norway]	The linkage with floods and drought through precip will be reassessed
14-702	14	41	38	41	51	On the basis of CMIP3, notable shifts towards warmer and/or drier climatic zones will occur in Europe during the ongoing century. The tundra climate will contract in the Scandinavian mountains, and will disappear in the Alps, at least on the large scale. • The temperate rainy zone (Cf) will penetrate north-eastwards in a wide sector between the surroundings of the Black Sea and the Baltic Sea, at the expense of the boreal rainy climate. Please see Jylhä, K., Tuomenvirta, H., Ruosteenoja, K., Niemi-Hugaerts, H., Keisu, K. and Karhu, J.A., 2010. Observed and projected future shifts of climatic zones in Europe, and their use to visualize climate change information. Weather, Climate, and Society, 2:2, 148-67. And references therein. http://journals.ametsoc.org/doi/abs/10.1175/2010WCAS1010.1 [Kirsti Jylhä, Finland]	This will be assessed. But Boberg and Christensen 2012 have shown that this shift may be partly a model artefact.
14-703	14	41	48	41	51	In percentage terms, the largest reductions in the number of frost days (FD) are projected to occur in western and southern Europe and in autumn and spring, rather than in winter. The regions of large projected percentage reductions in the future roughly coincided with those currently having considerable inter-annual	to be considered

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						variation of FD according to observations. See Jylhä K., Fronzek, S., Tuomenvirta, H., Carter, T.R. and Ruosteenoja, K. 2008: Changes in frost, snow and Baltic Sea ice by the end of the twenty-first century based on climate model projections for Europe. <i>Clim. Change</i> , 86, 441-462. http://www.springerlink.com/content/b74186u33916vw82/ [Kirsti Jylhä, Finland]	
14-704	14	41	53	41	53	the title should be "Mediterranean Region" [ANNALISA CHERCHI, Italy]	Taken into account. This subsection will be entirely re-wrote
14-705	14	41	53	43	57	In this subsection the regions are not well identified (i.e. what is the "european med region"?). Eventually it would be better to refer to Nations or geographic names [ANNALISA CHERCHI, Italy]	Taken into account. This subsection will be entirely re-wrote
14-706	14	41	53	43	57	Grammar, style, capitalizations, and punctuation of the entire section need to be improved. [Christian Reuten, Canada]	Taken into account. This subsection will be entirely re-wrote
14-707	14	41	53			Sect.14.3.6.2: I would like to see discussion of winter and summer clearly separated in this section, since very different processes of future change operate in each. For the summer, there needs to be much more discussion of the projected changes in land-atmosphere processes, which it is generally agreed are the dominant processes that drive future change in southern Europe, i.e. spring soil moisture declines, summer soil moisture feedbacks, and land-sea temperature contrasts, eg. Rowell and Jones (2006), Rowell (2009), Seneviratne (2006) and others cited therein. See comment #25 for citations. [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Taken into account. This subsection will be entirely rewritten
14-708	14	41	53			It would be relevant here to recall some former results on ENSO link with the Mediterranean basin. In Mariotti et al., (2002), using observational datasets and atmospheric reanalyses, they show that interannual variability of rainfall in the Euro-Mediterranean sector is significantly influenced by ENSO in a way that is seasonally varying. Spatially coherent correlation patterns are found in central and eastern Europe during winter and spring, and in western Europe and the Mediterranean region during autumn and spring. Mariotti, A., N. Zeng, and K.-M. Lau (2002), Euro-Mediterranean rainfall and ENSO—a seasonally varying relationship, <i>Geophys. Res. Lett.</i> , 29(12), 1621, doi:10.1029/2001GL014248 [Paolo Michele Ruti, Italy]	Accepted
14-709	14	41	55	43	57	This is a well written section but probably has too much detail, especially in comparison to the previous section on Northern Europe, for instance. There are lots of examples of less indeterminate signals cited, these could be removed to focus on the more consistent responses [George Kiladis, USA]	Taken into account. This subsection will be entirely re-wrote
14-710	14	41				For some papers showing climate model projections for Finland / Europe, please see http://en.ilmatieteenlaitos.fi/acclim-publications [Kirsti Jylhä, Finland]	Taken into account. This subsection will be entirely re-wrote
14-711	14	42	7	42	9	The sentence is grammatically incorrect and makes little sense. [Christian Reuten, Canada]	Accepted, but this subsection will be entirely re-wrote
14-712	14	42	9	42	9	Insert "NAO" after "(positive)" [ANNALISA CHERCHI, Italy]	Accepted, but this subsection will be entirely re-wrote
14-713	14	42	11	42	11	change "basin" with "Mediterranean Sea" [ANNALISA CHERCHI, Italy]	Accepted, but this subsection will be entirely re-wrote
14-714	14	42	12	42	12	change "Mediterranean" with "water" [ANNALISA CHERCHI, Italy]	Accepted, but this subsection will be entirely re-wrote
14-715	14	42	42	42	42	usually lasts [Matthias Zahn, United Kingdom]	Accepted, but this subsection will be entirely re-wrote
14-716	14	42	55	42	55	may weaken [Matthias Zahn, United Kingdom]	Accepted, but this subsection will be entirely re-wrote
14-717	14	43	17	43	19	Recent EU and international projects (CIRCE-EU, CORDEX) have progressed in developing regional coupled models in order to better simulate climate variability and scenarios. In Artale et al. (2009) an atmosphere–ocean regional climate model for the Mediterranean basin, called the PROTHEUS system, has been assessed by using available observational datasets. Despite a persistent bias, the PROTHEUS system is able to capture the inter-annual variability of seasonal sea surface temperature (SST) and also the fine scale spatio-temporal evolution of observed SST anomalies, with spatial correlation as high as 0.7 during summer. The close inspection of a 10-day strong wind event during the summer of 2000 proves the capability of the PROTHEUS system to correctly describe the daily evolution of SST under strong air–sea interaction conditions. While	Taken into account. This subsection will be entirely re-wrote

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						concerning scenarios, in Dell'Aquila et al. (2011) a more accurate description of orography produces in the regional coupled model a narrower identification of the effects of a warmer climate on intense precipitation events and on other key environmental indicators, such as the snow cover extension and the aridity index. An example of the impact of climate variability on river discharge is also evident for a medium/small-size catchment basin in Northern Italy, the Po river. REFERENCES 1) Vincenzo Artale, Sandro Calmanti, Adriana Carillo, Alessandro Dell'Aquila, Marine Herrmann, Giovanna Pisacane, Paolo M. Ruti, Gianmaria Sannino, Maria Vittoria Struglia, Filippo Giorgi, Xunqiang Bi, Jeremy S. Pal, Sara Rauscher, The PROTHEUS Group, 2009 An atmosphere-ocean regional climate model for the Mediterranean area: assessment of a present climate simulation Clim. Dyn. doi:10.1007/s00382-009-0691-8; 2) Dell'Aquila A., Calmanti S., Ruti P. M., Struglia M. V., Pisacane G., Carillo A., Sannino G., 2011 Impacts of seasonal cycle fluctuations in an A1B scenario over the Euro-Mediterranean. Climate Research Clim. Res. doi:10.3354/cr01037 [Paolo Michele Ruti, Italy]	
14-718	14	43	34	43	40	Concerning extreme events, in few months it will appear the book "The Climate of the Mediterranean Region", Edited by P. Lionello, where in chapter 8 (S Plankton et al.) extremes value theory has been applied to the climateprediction.net project which is the first distributed computing climate project of its kind (Allen, 1999). The probability distribution function (pdf) of the all time series and of the extreme's time-series is analyzed. The boxplot of the all time series shows a significant shift of the bulk of the pdf in the case of the scenario respect to the present climate data. Both for the minima and for the maxima show a shift of about 3° C for the Mediterranean region. [Paolo Michele Ruti, Italy]	Taken into account. This subsection will be entirely re-wrote
14-719	14	43	57			On the basis of CMIP3, notable shifts towards warmer and/or drier climatic zones will occur in Europe during the ongoing century. The dry semiarid zone will expand in the Iberian Peninsula, in Italy, on the western and northern coasts of the Aegean Sea and the Black Sea, and in the vicinity of the Caspian Sea. Please see Jylhä, K., Tuomenvirta, H., Ruosteenoja, K., Niemi-Hugaerts, H., Keisu, K. and Karhu, J.A., 2010. Observed and projected future shifts of climatic zones in Europe, and their use to visualize climate change information. Weather, Climate, and Society, 2:2, 148-67. And references therein. http://journals.ametsoc.org/doi/abs/10.1175/2010WCAS1010.1 [Kirsti Jylhä, Finland]	Taken into account. This subsection will be entirely re-wrote
14-720	14	44	4		13	There is also the configuration of the coast (towards the coastline over the monsoon) which also influences rainfall in the Gulf of Guinea [Ibouraïma YABI, Benin]	Accepted. Text revised
14-721	14	44	4			I think to say Africa is "quite homogeneous in the zonal direction" is possibly an optimistic perspective. Within zonal bands there is often very strong inhomogeneity. [Bruce Hewitson, South Africa]	Accepted. Text revised to read "to zeroth order approximation" instead of "quite".
14-722	14	44	10	44	24	I think the statement uncertainty in the response of the land to changes in precipitation have to be supported by references such as the results from the WAMME experiments. Druyan, L.M., J. Feng, K.H. Cook, Y. Xue, M. Fulakeza, S.M. Hagos, A. Konaré, W. Moufama-Okia, D.P. Powell, E.K. Vizy, and S.S. Ibrah, 2010: The WAMME regional model intercomparison study. Clim. Dynam., 35, 175-192, doi:10.1007/s00382-009-0676-7. Eventhough they are regional and 20th century they give an idea on the uncertainty. [Samson Hagos, USA]	References will be added if the assessment of the work support statements
14-723	14	44	15			Sect.14.3.7.1: This section could be shortened. Presumably the intention is to focus more on future changes, than on current climate and 20th century variability which have been covered elsewhere? [David Rowell, United Kingdom of Great Britain & Northern Ireland]	Accepted. The discussion of 20th century variability and attribution has been shortened.
14-724	14	44	17		28	Indicate the sources of information and do not forget to check the work of AMMA [Ibouraïma YABI, Benin]	Accepted. We have added a reference to Lebel et al 2010
14-725	14	44	27	44	28	Here I would suggest to add a review paper on intra-seasonal variability over West Africa. Janicot, S., Caniaux, G., Chauvin, F., de Coëtlogon, G., Fontaine, B., Hall, N., Kiladis, G., Lafore, J.-P., Lavaysse, C., Lavender, S. L., Leroux, S., Marteau, R., Mounier, F., Philippon, N., Roehrig, R., Sultan, B. and Taylor, C. M. (2011), Intraseasonal variability of the West African monsoon. Atmospheric Science Letters, 12: 58–66. doi: 10.1002/asl.280 [Paolo Michele Ruti, Italy]	Accepted. Reference added
14-726	14	44	33	44	33	expression "exhibit and bulk indices", you are referring to correlation between which parameters? [ANNALISA CHERCHI, Italy]	Accepted: We now say "basin-wide area averages"

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14-727	14	44	39	44	39	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected: no motivation was given to support the request.
14-728	14	44	46	44	48	is this paragraph referred to Sahel? not clear [ANNALISA CHERCHI, Italy]	Taken into account: Paragraph was deleted
14-729	14	44	50	44	50	change "rests in part" with "depends" [ANNALISA CHERCHI, Italy]	Taken into account: Paragraph was deleted
14-730	14	44	50	44	50	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected: no motivation was given to support the request.
14-731	14	44		46		Delete the subtitle" 14.3.7.1" as long as it is unnecessary to" 14.3.7.2" there can not be '14 .3.7.1". In other words, when you give a subtitle, this assumes that there is at least one second. Also I think we can not reduce the whole of Africa in the Sahel alone! There remains the other climatic zones (Sudanian, subequatorial and equatorial). Analysis 14.3.7 deserves to be better structured ! [Ibouraïma YABI, Benin]	Rejected: the plan is to have other sub-sections in the next draft
14-732	14	45	1	45	1	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected: no motivation was given to support the request.
14-733	14	45	1	45	4	I would suggest to add a statement here concerning the link with ENSO in terms of mean response and of intra-seasonal variability. Joly et al. (2007) and Joly and Voldoire (2008) analyzed the variability of the West African monsoon precipitation, focusing on its correlation with tropical SSTs from inter-annual to multi-decadal scales. While, Ruti and Dell'Aquila (2010) showed that despite the fact that several models correctly reproduce the ENSO phenomena, many models are still unable to capture the teleconnection mechanism, which bridges the Pacific SST forcing to the West African intra-seasonal variability. REFERENCES 1) Joly M, Voldoire A, Douville H, Terray P, Royer J, 2007: African monsoon teleconnections with tropical SSTs: validation and evolution in a set of IPCC4 simulations. Climate Dynamics 29, 1-20; 2) Joly M, Voldoire A, 2008: Influence of ENSO on the West African monsoon: temporal aspects and atmospheric processes. J of Climate, DOI: 10.1175/2008JCLI2450.1; 3) Ruti PM and Dell'Aquila A., 2010 The twentieth century African easterly waves in reanalysis systems and IPCC simulations, from intra-seasonal to inter-annual variability Clim. Dyn. doi:10.1007/s00382-010-0894-z [Paolo Michele Ruti, Italy]	Taken into account: 2 of the suggested references were added
14-734	14	45	4	45	6	I wonder if 'missing some important processes' might be misleading. The processes are not explicitly modelled, but they are accounted for in form of parameterizations. [Christian Reuten, Canada]	Accepted. Text revised
14-735	14	45	10	45	10	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected: no motivation was given to support the request.
14-736	14	45	26	45	29	So the authors are claiming that evidence for the statements did not exist before AMMA, while it is more likely that the authors are not aware of previous work. I suggest a less contentious statement like 'First, the AMMA experiment provides observational evidence that...' I also suggest starting a new paragraph after this sentence and after line 51. [Christian Reuten, Canada]	Accepted. Text revised (and this sentence was moved to another paragraph)
14-737	14	45	26	45	42	I suggest to reduce this paragraph, to eventually mention the concept for RCM, but the details should be included in the chapter dedicated to RCM. [ANNALISA CHERCHI, Italy]	The section will redrafted
14-738	14	45	26			Spell out the acronym 'AMMA'. [Christian Reuten, Canada]	Accepted. Text revised
14-739	14	45	40	45	42	The role of the representation of deep convection on key elements of the West African summer monsoon climate is also relevant in this context. Sylla et al. (2011) have investigated the role of deep convection and they showed that the presence of deep convective heating along the intertropical convergence zone sustains increased lower-level baroclinicity favoring intensification of the jet core and leading to a more realistic African easterly jet. This result indicates that orographic friction and low-level large-scale moisture convergence may play the dominant role in the genesis and growth of AEWs and that deep convection acts to strengthen the overall wave activity and to favor their west coast development REFERENCE M. B. Sylla, F. Giorgi, P. M. Ruti, S. Calmanti, A. Dell'Aquila, 2011 The impact of deep convection on the West African summer monsoon climate: a regional climate model sensitivity study Q. J. R. Meteorol. Soc. doi:10.1002/qj.853 [Paolo Michele	Rejected: outside the scope of this discussion.

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						Ruti, Italy]	
14-740	14	45	44	45	51	This paragraph could be made a bit easier to understand by making it more clear where each of the two forcings is explained. The word 'Instead' in line 49 is particularly confusing and should probably be substituted with 'By comparison'. [Christian Reuten, Canada]	Taken into account: text revised.
14-741	14	45	47	45	47	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected: no motivation was given to support the request.
14-742	14	45	49			Re: water vapor feedback: It is pretty simple to put an upper-bound on the magnitude of the feedback from water vapor. You simply use MODTRAN to calculate the warming effect of CO2 absent any feedbacks (i.e., with constant H2O partial pressure), and also with the water vapor feedback (i.e., with constant relative humidity), and compare the two. The answer is that, in the absence of other feedbacks, water vapor would amplify the warming effect from CO2 by about 65%. I've run the numbers through MODTRAN for various CO2 levels, and entered the results into an Excel spreadsheet, here: http://www.burtonsys.com/climate/MODTRAN_etc.html These calculations do not take into account other feedbacks, which, in net effect, are almost certainly negative: especially increased evaporation causing increased water-cycle cooling (which the Report seems to ignore entirely, unless I missed it somewhere!), and probably increased cloudiness. So that 65% amplification figure is really an upper-bound. The net amplification including water vapor might be positive, or it might be negative, but we can say with good confidence that it is not greater than 65%. [David Burton, USA]	Noted
14-743	14	45	53	45	54	A relevant paper on the dynamics of this regional process (heat low) should be quoted here, Chauvin et al. (2010). They characterized the intraseasonal variations of the Saharan Heat Low and its link to mid-latitudes. REFERENCES Chauvin, Fabrice, Romain Roehrig, Jean-Philippe Lafore, 2010: Intraseasonal Variability of the Saharan Heat Low and Its Link with Midlatitudes. J. Climate, 23, 2544–2561. doi: http://dx.doi.org/10.1175/2010JCLI3093.1 [Paolo Michele Ruti, Italy]	Accepted. Reference added
14-744	14	45				Here's an excerpt from the spreadsheet: MODTRAN tropical atmosphere, clear sky Temp offset from 299.7K @ lout=287.655 CO2 (ppm) description const H2O pressure const rel hum 0 no CO2 -7.47 -12.40 19.6 half of current warming -3.74 -6.12 285 est. pre-industrial -0.40 -0.66 300 est. 1900 -0.34 -0.56 305 est. 1930 -0.32 -0.53 310 est. 1950 -0.30 -0.49 315 1958, first Mauna Loa meas. -0.28 -0.46 392 current (Mauna Loa) 0 0 570 est. doubling vs. pre-indust. 0.48 0.79 Note the 2nd line in the table, for just 19.6 ppm CO2. MODTRAN calculates that that's all the CO2 that would be needed to generate fully half of the warming which our current 392 ppm gives us. The diminishing effect of additional CO2 is because there's already more than enough CO2 in the atmosphere to make it almost completely opaque in CO2's main absorption bands. [David Burton, USA]	Noted
14-745	14	46	3	46	4	sentence starting with reference and ending with "historical data" is incomplete [ANNALISA CHERCHI, Italy]	Accepted. Text revised
14-746	14	46	3	46	4	Specify the 'middle-of-the-road scenario' and maybe substitute with a more formal expression. Also, what is meant by 'that' in line 4? [Christian Reuten, Canada]	Accepted. Text revised
14-747	14	46	20	46	20	the regions indicated here (to be filled in) differ from the list in the first paragraph of this section (page 44, lines 12-13) [ANNALISA CHERCHI, Italy]	Accepted. Text revised at the beginning of the section

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14-748	14	46	20	50	34	The traditional Asia division is different from here, why doesn't use the traditional one?(Qiyong Liu, China CDC) [Qiyong Liu, China]	We try to follow WG-II outlined regions
14-749	14	46	24	46	36	One could insert here a reference to rather interesting results on the role of NAO and SCAND in air temperature and snow depth variations in North Eurasia in 1950-2005: together they explain 100% of the winter warming trend since 1970 (Popova, Shmakin, 2010) and a major part of snow depth variations (Popova, 2007). Moreover, these two studies revealed that relative importance of certain circulation modes can vary on decadal scale: for North Eurasia, SCAND was the most influential mechanism in 1950-1975, while since 1975 the leading role passed to NAO. The references are: Popova V. (2007) Winter snow depth variability over northern Eurasia in relation to recent atmospheric circulation changes. International Journal of Climatology, Vol. 27, pp.1721-1733. Popova V., Shmakin A. (2010). Regional structure of surface air temperature variations in North Eurasia in the second half of 20th - beginning of 21st centuries. Izvestiya Atmospheric and Oceanic Physics, Vol. 46, No 2, pp. 15-29. [Andrey Shmakin, Russia]	Taken into account. Combined with other comments for text revision.
14-750	14	46	24	46	36	One could insert here a reference to rather interesting results on the role of NAO and SCAND in air temperature and snow depth variations in North Eurasia in 1950-2005: together they explain 100% of the winter warming trend since 1970 (Popova, Shmakin, 2010) and a major part of snow depth variations (Popova, 2007). Moreover, these two studies revealed that relative importance of certain circulation modes can vary on decadal scale: for North Eurasia, SCAND was the most influential mechanism in 1950-1975, while since 1975 the leading role passed to NAO. The references are: Popova V. (2007) Winter snow depth variability over northern Eurasia in relation to recent atmospheric circulation changes. International Journal of Climatology, Vol. 27, pp.1721-1733. Popova V., Shmakin A. (2010). Regional structure of surface air temperature variations in North Eurasia in the second half of 20th - beginning of 21st centuries. Izvestiya Atmospheric and Oceanic Physics, Vol. 46, No 2, pp. 15-29. [Andrey Shmakin, Russia]	duplicate with 14-749
14-751	14	46	26	46	26	After "140°E" add: "The warming trend was particularly enhanced, in the boreal cold season (Nov. to Mar.) over semi-arid regions, showing a temperature increase of 1.53°C as compared to the global annual mean temperature increase of 1.13°C over land. In mid-latitude semi-arid areas of Asia, temperatures in the cold season increased by 2.42°C (Huang et al, ACPD, 2012)." Reference: Huang, J., Guan, X., and Ji, F. 2012: Enhanced cold-season warming in semi-arid regions, Atmos. Chem. Phys. Discuss., 12, 4627-4653, doi:10.5194/acpd-12-4627-2012. [Jianping Huang, China]	Taken into account. Combined with other comments for text revision.
14-752	14	46	34	46	34	anthropogenic The term should never be used in this context, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-753	14	46	35	46	35	a lon-lat box should be indicated for Central Asia [ANNALISA CHERCHI, Italy]	Accepted.
14-754	14	46	38	46	54	Grammar, style, and punctuation of the entire paragraph need to be improved. [Christian Reuten, Canada]	Editorial.
14-755	14	46	45	46	46	The description of the two downscaling methods is not particularly helpful. I suggest either dropping them or if the authors feel that this information is relevant for the interpretation of the results, elaborating enough so that the reader can understand and appreciate the difference between the two methods. [Christian Reuten, Canada]	Accepted. Brief explanation of a pseudo global warming method is added.
14-756	14	47	11	47	27	Please consider including the findings of the analysis of long period of precipitation data of Hong Kong. There is a long term rising trend in the annual rainfall and the frequency of occurrence and intensity of heavy rain events in Hong Kong exhibited a long term increasing trend from 1885 to 2008. Reference: - Wong, M. C., H. Y. Mok, and T. C. Lee, 2010: Observed changes in extreme weather indices in Hong Kong. Int. J. Climatol., Published online in October 2010, doi:10.1002/joc.2238, 12 pp - Ginn, W.L., T.C. Lee and K.Y. Chan, 2010: Past and Future Changes in the Climate of Hong Kong, Acta Meteorologica Sinica, 24(2), 163-175 (English Edition). [Tsz-cheung Lee, Hong Kong]	accepted and will cite the new papers in the revision
14-757	14	47	12	47	15	the following statement is questionable, since the change around the late 1970s was a decadal shift (see Hu 1997 and some follow-up works), which was consistent the change of global climate system. [Zeng-Zhen HU, USA]	accepted and will re-vise it as suggested
14-758	14	47	12	47	15	"The recent warming in the Tropics, which reduces the land-sea temperature contrast represented by the	accepted

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						tropospheric mean temperature, is a primary cause for the weakening of the East Asian summer monsoon since the late 1970s (Li et al., 2010; Zhou and Zou, 2010), resulting in increased droughts in northern China and flood in southern China." [Zeng-Zhen HU, USA]	
14-759	14	47	15	47		The "southern China flood and northern China drought (SFND)" is proposed as one of the major features of the decadal change in East-Asian Monsoon. Using hourly station rainfall rain gauge data, some new facts about this phenomenon have been revealed and might be included here. "Analysis of hourly rainfall data revealed the changes in characteristics of summer rainfall over the eastern China. The south flooding was mainly resulted from increasing rainfall frequency with moderate and low intensity which was contributed from longer duration of rainfall events. The north drought coexisted with increased rainfall intensity, especially in the short duration rainfall events. The high intense rainfall did not contributed to SFND, which is sharply against the result from daily rainfall product." (Yu et al., 2010, Changes in characteristics of late-summer precipitation over eastern China in the past 40 years revealed by hourly precipitation data. J. Clim.) (Li et al. 2011, Changes in duration-related characteristics of late-summer precipitation over eastern China in the past 40 years. J. Clim.) [Rucong Yu, China]	"accepted and will revise it based on the new papers: Rainfall over the eastern China exhibited a so-called southern flooding and northern drought (SFND) pattern over eastern China in recent decades. Yu et al. (2010) found that although the rainfall amount and frequency have significantly increased (decreased) in the mid-lower reaches of the Yangtze River valley (North China), the rainfall intensity has decreased (increased). Results also show that the SFND pattern is mostly attributed to changes in precipitation with moderate and low intensity rather than the extreme rainfall. These findings differ from previous results based on daily data. Yu and Li (2012) pointed out that there are significant negative correlations between the percentage of moderate rainfall and the surface air temperature. The relation between the extreme rainfall and the temperature is not obvious and positive correlations can only be found over the South China where the water supply is sufficient. Li et al. (2011) showed that the decadal decreases of rainfall amount over North China are largely contributed by long duration rainfall events, especially those occurring between midnight and morning. In the mid-to-lower reaches of the Yangtze River valley, both the frequency and amount of long duration precipitation have significantly increased. Yu, R., J. Li, W. Yuan, and H. Chen, 2010: Changes in Characteristics of Late-Summer Precipitation over Eastern China in the Past 40 Years Revealed by Hourly Precipitation Data. Journal of Climate, 23, 3390-3396. Li, J., R. Yu, W. Yuan, and H. Chen, 2011: Changes in duration-related characteristics of late-summer precipitation over eastern China in the past 40 years. Journal of Climate, 24, 5683-5690. Yu, R., and J. Li, 2012: Hourly rainfall changes in response to surface air temperature over eastern contiguous China. Accepted by Journal of Climate. "
14-760	14	47	16	47		This decreasing trend of light rain was revealed from daily rainfall data. Using hourly data, opposite conclusion has been drawn. "However, using the hourly rainfall data instead of daily data, it has been found that both the frequency and amount of light rain in the mid-lower reaches of the Yangtze River valley have increased." (Yu et al., 2010, Changes in characteristics of late-summer precipitation over eastern China in the past 40 years revealed by hourly precipitation data. J. Clim.) [Rucong Yu, China]	accepted , see response to Item-759.
14-761	14	47	20	47	21	which index of precipitation? details should be included [ANNALISA CHERCHI, Italy]	mean precipitation
14-762	14	47	34	47	37	This long sentence is not clear and should probably be broken up and rephrased. [Christian Reuten, Canada]	will revise as suggested

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14-763	14	47	44	48	11	Please consider including the results of the study conducted by Sun and Ding (2010) on the changes in the East Asian monsoon precipitation in the 21st century. They indicated that the increase in precipitation in China may be attributed to the combined effect of the increase in the atmospheric moisture content and strengthening of the monsoon circulation in East Asia. Reference : - Sun, Y., and Y. Ding, 2010: A projection of future changes in summer precipitation and monsoon in East Asia. Science China Earth Sciences, 53(2), 284-300. [Tsz-cheung Lee, Hong Kong]	accepted and will cite the new paper in SOD along with a revision of the text
14-764	14	47	44	48	35	Please consider including the results of the study conducted by Lee et al. (2012) on the possible changes in the frequency of extreme rainfall events in Hong Kong in the 21st century. By statistical downscaling 30 sets of CMIP3 multi-model ensemble scenario projections, they suggest that, in the 21st century, the annual number of rain days in Hong Kong is expected to decrease while the daily rainfall intensity will increase, concurrent with the expected increase in annual rainfall. Reference : Lee T.C., Chan K. Y., Chan H. S. and Kok M. H., 2011: Projections of extreme rainfall in Hong Kong in the 21st century. Acta Meteor. Sinica (English edition), 25(6), 691-709. [Tsz-cheung Lee, Hong Kong]	accepted and will cite the new publication in SOD
14-765	14	47	53	48	14	Grammar, style, and punctuation need to be improved. [Christian Reuten, Canada]	Editorial.
14-766	14	48	2	48	2	Kusunoki et al. (2011) is missing in references list. [Shoji Kusunoki, Japan]	Editorial.
14-767	14	48	13	48	13	not clear meaning of "Sapporo's climate moves about 3.5 degrees" [ANNALISA CHERCHI, Italy]	Noted. Text corrected.
14-768	14	48	13	48	14	Is that true: Sapporo's cool climate is expected to be found 3.5 degrees further SOUTH in 100 years? [Christian Reuten, Canada]	Noted. Text corrected.
14-769	14	48	17	48	35	for results mentioned in this paragraph it should be highlighted the limitation of using forced AGCM, as the ocean-atmosphere coupling is missing [ANNALISA CHERCHI, Italy]	Accepted. Text will be modified.
14-770	14	48	17			The regional 30-year return level of daily precipitation in the region is likely to increase by 6.9%–29.1% in southern part of Japan in the late 21st century. Koji Ishihara: "Quantifying the Uncertainty Range of 30-Year Daily Precipitation Change due to Global Warming Using Regional Frequency Analysis", Hydrological Research Letters, Vol. 4, pp.90-94, (2010) . [Tosiyuki Nakaegawa, Japan]	Accepted. This point and reference is added.
14-771	14	48	18	48	19	Insert the following sentence between line 18 and 19; The increase of precipitation intensity in summer over East Asia is projected by CMIP3 models associated with the increase of moisture transport around subtropical high (Kusunoki and Arakawa, 2011). [Shoji Kusunoki, Japan]	Accepted. This point and reference is added.
14-772	14	48	19	48	19	reproduce extreme rainfall. ---> reproduce extreme rainfall. (Kusunoki et al., 2006). [Shoji Kusunoki, Japan]	Rejected. Not necessary here.
14-773	14	48	19			That should probably be toned down. There is evidence (and it is plausible) that increased horizontal resolution will improve extreme precipitation prediction, but this is not necessarily the case, in particular not over all areas. [Christian Reuten, Canada]	Rejected.
14-774	14	48	21	48	23	The sentence starting with 'Kamiguchi et al. (2006)' ---> The MRI-JMA 20-km mesh AGCM shows that heavy precipitation increases notably in Bangladesh, the Yangtze River basin (Kamiguchi et al., 2006) and in East Asia (Kusunoki and Mizuta, 2008) due to the intensified convergence of water vapour flux in summer at the end of the 21st century. [Shoji Kusunoki, Japan]	Accepted. Text modified.
14-775	14	48	23	48	26	A long sentence that takes several times of reading. Try to break it up into three sentences. Moreover, specify which RCM and AGCM was used or else use the indefinite article 'a'. [Christian Reuten, Canada]	Accepted. Text modified.
14-776	14	48	42	48	43	change ",but variable amounts of summer monsoon driven precipitation" with "precipitation with variable amounts driven by the summer monsoon" [ANNALISA CHERCHI, Italy]	Agreed
14-777	14	48	45	48	45	insert "(mainly NAO)" after "circulations" before "influence" [ANNALISA CHERCHI, Italy]	Agreed
14-778	14	48	46	48	48	remove "largely govern by the NAO" [ANNALISA CHERCHI, Italy]	Agreed
14-779	14	48	48	48	48	change "and rain is mainly received" with "with rain mainly concentrated" [ANNALISA CHERCHI, Italy]	Agree

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14-780	14	48	50	49	7	This paragraph needs some editing. [Christian Reuten, Canada]	Acknowledged
14-781	14	48	53	48	56	this results have been already reported in section 14.3.6 [ANNALISA CHERCHI, Italy]	Acknowledged -double checking and reformulation if needed
14-782	14	49	1	49	2	What is the relevance of the phrase 'both following a dry or a wet day'? [Christian Reuten, Canada]	Text will be reformulated
14-783	14	49	11	49	21	Some of the aspects are repeated here - the authors of the write-ups in Pages 13-14 and in Page 49, have to reconcile this issue. Further, no physical insights provided - this reviewer finds a "summation of different pieces" from different articles without coherency. [H Annamalai, USA]	Noted. Text will be modified.
14-784	14	49	12	49	13	may include following reference: [Zeng-Zhen HU, USA]	Rejected. Old reference.
14-785	14	49	12	49	13	Hu, Z.-Z., M. Latif, E. Roeckner, and L. Bengtsson, 2000: Intensified Asian summer monsoon and its variability in a coupled model forced by increasing greenhouse gas concentrations. Geophys. Res. Lett., 27 (17), 2681-2684. [Zeng-Zhen HU, USA]	Rejected. Old reference.
14-786	14	49	15	49	15	" The aerosol indirect effect is not explicitly" . The paper by Bollasina et al. (2011) has taken the indirect effect into account. [Madhavan Nair RAJEEVAN, India]	Accepted. Text modified.
14-787	14	49	18	49	18	"from 6 models is strengthened" may be changed into "from 6 models has strengthened" [Madhavan Nair RAJEEVAN, India]	Editorial.
14-788	14	49	25	49	25	The reference of Rajeevan et al. (2008) (Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data, M Rajeevan, Jyoti Bhate and A.K.Jaswal, Geophysical Research Letters, 2008, Vol.35, L18707, doi 10.1029/2008GL035143) may be also included for extreme rainfall events. [Madhavan Nair RAJEEVAN, India]	Accepted. Reference will be added.
14-789	14	49	26	49	28	The sentence " Over India..." may need an editing. Suggest to remove " Over India". Start with " Using 50-km resolution..." [Madhavan Nair RAJEEVAN, India]	Accepted. Text modified.
14-790	14	49	29			Also line 35-36: is 'super-high-resolution model' a well defined term? For example, does a super-high-resolution model have a better resolution than a high-resolution model, and what defines the difference? [Christian Reuten, Canada]	Noted.
14-791	14	49	31	49	31	"over west coasts" may be written as" Over the west coasts" [Madhavan Nair RAJEEVAN, India]	Editorial.
14-792	14	49	43	49	43	"multi-model ensemble of shows" may be written as "multi-model ensemble which shows" [Madhavan Nair RAJEEVAN, India]	Accepted. Text corrected.
14-793	14	49	44	49	44	may cite Hu et al. 2000 here. [Zeng-Zhen HU, USA]	Rejected. Old reference.
14-794	14	49	44	49	44	Hu, Z.-Z., M. Latif, E. Roeckner, and L. Bengtsson, 2000: Intensified Asian summer monsoon and its variability in a coupled model forced by increasing greenhouse gas concentrations. Geophys. Res. Lett., 27 (17), 2681-2684. [Zeng-Zhen HU, USA]	Rejected. Old reference.
14-795	14	49	46	50	34	There have been some studies on regional climate change for Thailand and Southeast Asia using high resolution regional climate models(RCMs) but have not been revealed in this report. May I include parts of the research work for Thailand in this AR5 report as the following, please? " Employing the 60-km resolution WRF RCM forced with ECHAM5 by (Chotamonsak J., et al, 2010) the 2050s projected warming over Southeast Asia potentially varies from <0.1 to 3 °C compared to the 1990s reference period depending on locations and seasons. Projected warming will occur with greater warming during nighttime than daytime for all seasons. Precipitation increases on average with local decreases during the dry season. As expected from the 15-km mesh MM5 RCM by (Kreasuwun J., et al, 2011), the warming throughout Thailand will possibly be up to 1.2 °C while the rainfall amount will likely be less except southern Thailand and mountainous areas throughout the country during 2010-2039 relative to the 1970-1999 reference period on both SRES A2 and A1B. From the 20-km resolution WRF RCM outputs, Chotamonsak C., 2011 reported that the 2045-2064 projected warming would likely be about 1.41 °C averaged throughout Thailand relative to the 1990-2009 reference period with	Accepted. Text will be modified using this information.

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						<p>greater warming at nighttime than daytime, leading to decreasing diurnal temperature range of about 0.22 °C. As expected, the highest increase in temperature is in the rainy season and the mid of the cool season, while the lowest temperature increase occurs during the early stage and the end of the cool season. The highest warming possibly takes place in central Thailand while the smallest warming is likely pronounced over southern Thailand. The decreasing rate of precipitation during June-August is potentially related to the weakening trend of the southwest summer monsoon. The increase in pre-monsoon precipitation (especially in April) is likely from increasing moisture transport from the oceans across Thailand and nearby countries leading to intensified thunderstorm precipitation. The increase in late monsoon precipitation (October) is anticipated from the strengthening of tropical cyclones with consequent slightly extension of the rainy season. The pronounced decrease in the number of wet days with an increase in precipitation intensity is expected across most parts of Thailand.</p> <p>References: Chotamonsak C., Salathe E.P., Kreasuwan J., Chantara S., and Siriwitayakorn K., 2010: Projected Climate Change over Southeast Asia simulated using a WRF Regional Climate Model. <i>Atm. Sci. Let. II</i>: 000-000; DOI: 10.1002/asl.313 Chotamonsak, C., 2011 "Climate Change Simulations for Thailand Using Regional Climate Model". Ph.D. Thesis. Chiang Mai University, 2011.</p> <p>Kreasuwun J., et al., 2011: Climate Change Simulations for Thailand by the MM5 Regional Climate Model. Final Report submitted to Thailand Research Fund. "</p> <p>[Jiemjai kreasuwun, Thailand]</p>	
14-796	14	49	46	50	34	There have been several reports recently on the role of absorbing aerosols on Indian monsoon rainfall, influencing the intensity of tropical cyclones and so on. [S K Sathesh, India]	Noted. This matter is related to all monsoon regions. We will treat this elsewhere.
14-797	14	49	50	49	50	a box with lon-lat details for "southeast Asia" should be included [ANNALISA CHERCHI, Italy]	Accepted.
14-798	14	49	50	49	57	This part of the paragraph needs some editing. [Christian Reuten, Canada]	Editorial.
14-799	14	49	51	49	51	Quantify significant decrease [Peter Burt, UK]	Accepted. Text modified.
14-800	14	50	1	50	5	The word 'significant' in these few lines should either be replaced by 'substantial' or if they are really 'statistically significant' it should be stated with the additional adverb to make this clear. [Christian Reuten, Canada]	Noted. Text modified.
14-801	14	50	1	50	8	Quantify when term 'significant' used. [Peter Burt, UK]	Noted. Text modified.
14-802	14	50	7	50	8	Do the previous sentences not clearly indicate that the northeast and the southwest monsoon strongly affect the rainfall patterns in Malaysia? [Christian Reuten, Canada]	Noted. Text modified.
14-803	14	50	14			Are these daily extremes? What is the relevance of increasing extreme low precipitation events? If this includes dry days, then this statement implies fewer rain days. If this statistics is only applied to days with precipitation (measurable or also days with traces of precipitation?) then what does that mean practically: less drizzle? [Christian Reuten, Canada]	Noted. Lau and Wu 2007 paper refer pentad mean data. They hypothesize increased efficiency for light rain due to SST increase.
14-804	14	50	30	50	32	Right now, the sentence sounds like the frequency spectra of temperature and ENSO time series indicate that extreme warm events coincide with El Nino events. This is impossible, because the frequency spectrum does not contain phase information to match the occurrence of warm events with El Nino events. The phase information would have to come from the time series while the frequency spectrum could indicate a similar occurrence rate. Given the broad 'peak' of the ENSO spectrum from two to seven years, there is little value in the frequency information, though. [Christian Reuten, Canada]	Rejected. This sentence refers to a timing of warm extremes and El Nino events.
14-805	14	50	32	50	34	Both sentences need to be grammatically cleaned up, and I suggest swapping them. [Christian Reuten, Canada]	Editorial.
14-806	14	50	36	51	29	This section is not really about Southeast Asia but specifically about the Maritime Continent, not "Climate	Accepted. Text structure modified.

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						Phenomena". [George Kiladis, USA]	
14-807	14	50	38	51	29	consider consolidating material from 14.2.2.3 here [George Kiladis, USA]	Accepted. Text structure modified.
14-808	14	50	47			"names"? [Christian Reuten, Canada]	Editorial.
14-809	14	50	48			"vise versa" would mean that weak monsoons ENHANCE sea-breeze and valley-breeze convergence and rainfall over the mountains. This last part of the sentence can probably be dropped safely rather than making this awkward claim. [Christian Reuten, Canada]	Accepted. Text deleted.
14-810	14	51	1	51	3	the paper Paeth et al 2010, contains both the results for monsoon frequency and for El Nino frequency? [ANNALISA CHERCHI, Italy]	Noted. Paeth et al. 2008 discuss monsoon intensity change and ENSO frequency change.
14-811	14	51	4	51	4	affect [Matthias Zahn, United Kingdom]	Editorial.
14-812	14	51	10	51	11	it is almost obvious that droughts and floods depends on how rainfall varies [ANNALISA CHERCHI, Italy]	Accepted. Text structure modified.
14-813	14	51	10	51	29	In these last three paragraph, the section is loosing its red thread, providing a collection of unrelated sentences. It seems that the intention is not to review but cite the literature. For example, the sentence in lines 15 to 17 has nothing to add to the preceding sentences. The sentence in line 19 is repetitive of many previous sentences. This entire section needs more structure. [Christian Reuten, Canada]	Accepted. Text deleted.
14-814	14	51	15	51	17	an what is the consequence of this? [ANNALISA CHERCHI, Italy]	Accepted. Text deleted.
14-815	14	51	19	51	23	this paragraph contains results already mentioned (Moron et al., 2010), results by Curtis et al 2007 that should be inserted in previous paragraph, and last sentence that refers to results not relevant to the issues of this part [ANNALISA CHERCHI, Italy]	Accepted. Text deleted.
14-816	14	51	27	51	29	This is a hugely important finding, and the authors should add the time scale of the forecasts. [Christian Reuten, Canada]	Accepted. This is not relevant to climate change. Text deleted.
14-817	14	51	38	51	39	Which "island to the east"? [Christian Reuten, Canada]	Editorial
14-818	14	51	38	51	42	The tendencies are very different over fairly distances. This is not surprising, given the extreme complexity in topography and sea-land distribution in this region. In my opinion, a more careful interpretation of the modelling results is warranted. The observation that large-scale patterns of change were somewhat similar, but smaller-scale differences were substantial (rather than "significant") lands further evidence to high uncertainties in the modelling results. [Christian Reuten, Canada]	Noted.
14-819	14	51	46	51	48	Is that possible for CMIP3 to reach these geographic details? [ANNALISA CHERCHI, Italy]	Rejected. Referring 60km CCAM results.
14-820	14	52	2	52	5	These two sentences make no sense. [Christian Reuten, Canada]	Accepted. Text deleted.
14-821	14	52	7	52	12	This paragraph needs some editing. [Christian Reuten, Canada]	Noted.
14-822	14	52	22			Section 14.3.12.1 The stated aim of 14.3 section is to assess future change. Future change was comprehensively assessed (in 2007) by 'Climate Change in Australia' and this report could be a starting point for some of this section. [Ian Watterson, Australia]	Noted, thanks. This section substantially revised.
14-823	14	52	24			Given that much of Australia has received more rainfall than average (BoM website) over the past three years, there seems too great a focus on drying trends. [Ian Watterson, Australia]	Noted, thanks. This section substantially revised.
14-824	14	52	28	52	29	In which seasons does the rainfall reduction occur, and how about the other months? [Christian Reuten, Canada]	Noted. This section substantially revised, noted seasonality of trends.
14-825	14	52	28	52	31	What is the difference in the statement of these two sentences? [Christian Reuten, Canada]	Noted, section revised.
14-826	14	52	34	52	42	Discussion of winter rainfall in SWWA is not complete with reference to the more recent work of van Ommen and Morgan (2010, Nature Geosci) which finds a connection between enhanced meridional circulation south of	Noted, thanks. Revised this section and incorporated new references, but not this particular one.

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						Australia, reduction of winter rainfall and concomitant increase in snowfall in coastal Antarctica. This permits a proxy for SWWA winter rainfall to be derived from an Antarctic ice core, and this shows that the recent decades are unusual in the last 750 years. The results also are consistent with model results (see also van Ommen and Morgan, 2010 for detail) which suggest that ozone forcing plays a role in this increased meridional exchange. [Tasman van Ommen, Australia]	
14-827	14	52	40	52	40	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-828	14	52	44	52	55	text states "Cai and Cowan (2008a) linked this to an increased (decreased) frequency of El Niño (La Niña) events." The correlation between IPO/PDO and the frequency of El Niño and La Niña events has long been established empirically (Kiem et al., GRL 2003; Kiem and Franks, Hydrol Proc., 2004; Franks, WSJ, 2004; Verdon and Franks, GRL, 2006; Henley et al., 2011). Nowhere in this paragraph is there a full exposition of the role of El Niño and La Niña, nor their multidecadal variability of both occurrence and magnitude of impact in Eastern Australia. Whilst the text discusses contemporary research questions associated with known SAM/IOD climate influences, it ignores the stronger more reliable and long-established link between La Niña and catastrophic flooding across eastern Australia (especially Kiem et al., 2003) - this is a serious deficiency in the text. The history of floods (and drought) in eastern Australia, especially southern Queensland and New South Wales, is one of multidecadal variability driven by the frequency and impact of El Niño and La Niña events. The recent La Niña events and the return of significant flood events akin to those last seen in the mid-1970's necessitates a more considered view of any outlook or projections for eastern Australia [Stewart Franks, Australia]	Noted. This section substantially revised.
14-829	14	52	44	52	55	In this paragraph, potential links of reduced rainfall with various large-scale phenomena are highlighted. Are there any known links between these phenomena - just as an example, pressure increases over southern Australia and positive trends in SAM - that could explain why droughts may be related to both trends? [Christian Reuten, Canada]	Noted, and yes there are. This paragraph is being revised and will include a better discussion of relationships between large-scale phenomena.
14-830	14	53	8	53	16	This entire paragraph should be removed. It displays fundamental misunderstanding of hydrology and boundary layer physics. As Noted above (comment 4). Nicholls (2004) did indeed make the claim that higher temperatures (caused by CO2), lead to higher evaporation and hence make the drought worse. Cai et al (2008b) did indeed continue Nicholls work, and did indeed claim that a 1degC increase leads to a 15% decrease in MDB inflows. Both papers have confused cause and effect. The non-linear nature of land surface hydrology means that, when in drought, a smaller fraction of rainfall becomes runoff. Also during drought, more of the incident net radiation is partitioned into sensible heat as moisture is limited for latent heat fluxes. Consequently it is the lack of moisture during a drought which causes a reduction in evaporation and a corresponding increase in sensible heating and hence higher air temperatures. (Lockart et al, GRL, 2009). Nicholls confused cause and effect with regard to temperature and evaporation. Cai et al have confused cause and effect with regard to temperature and runoff. It would be more reasonable and accurate to state that a 15% reduction in inflows would give rise to a 1degC increase in air temperature. Of these erring scientists, only Nicholls has understood this error, as demonstrated in Nicholls and Larssen (2011). An earlier chapter (chpt 2) cites Nicholls and Larsen (2011) where he shows that drought causes temperature increases, not vice versa. This was the conclusion of Lockart et al. (2009). This paragraph repeats a critical and gross error previously made in 4AR. The incorrect physics cite in 4AR should be corrected. Alternatively, the paragraph should be removed in its entirety. I note that the first word of this paragraph is 'indisputably' - this is clearly incorrect and the science is non-contentious, other than by those without the prerequisite knowledge, it reflects terribly on the author of this paragraph. [Stewart Franks, Australia]	Disagree. Temperature and moisture changes are both important to high temperature extremes and to drought. I understand that Lockart et al (2009) was clearly refuted by Cai et al (2010). Having said this, the paragraph in question, and the section it is
14-831	14	53	17			Simulated change in Australian rainfall differed considerably across CMIP3 models, and this was a feature of the 2007 Climate Change in Australia projections. Watterson (2011) found that this variation was strongly correlated to the gradient of SST rise to the north -via a Pacific-Indian Dipole index. While this might be linked to the ENSO and IOD modes, it is nevertheless a useful characterisation of the CMIP3 range. Consideration of this study (I. G. Watterson (2011) Understanding and partitioning future climates for Australian regions from CMIP3 using ocean warming indices. Climatic Change, doi:10.1007/s10584-011-0166-x, and references therein) appears warranted. [Ian Watterson, Australia]	Noted, thanks. Text modified.

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14-832	14	53	31	53	33	Later on in section 14.3.14 on Antarctica, strengthened circumpolar westerlies were associated with a general warming trend and modulations by the SAO rather than ENSO. [Christian Reuten, Canada]	Yes, but well south of New Zealand. Text as it stands is OK, as is the Antarctic section.
14-833	14	53	34	53	37	Can the authors provide additional numbers? As it reads now, without cool southerly flow, temperatures would have risen more than the observed 1 degree Celsius, which would be more than the global average of 0.7 degrees. [Christian Reuten, Canada]	The one degree warming over the past century is already larger than the global average, but that is a function of how natural variability has played out in that time. Please refer to the cited reference for more detail.
14-834	14	53	37	53	37	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	The word is not used in this line of text
14-835	14	53	39	53	43	These two sentences lack references. [Christian Reuten, Canada]	Very little in the refereed literature, apart from reports for government agencies. Have added what is available, and text modified.
14-836	14	53	51	53	51	not sure if Ministry of the Environment (2008) is a valid scientific reference [Matthias Zahn, United Kingdom]	Not fully refereed, but reviewed before publication. Different references added.
14-837	14	54	4	54	11	Other issues when investigating projections for Pacific islands (although these may also be important to other small countries) are mean-state biases and errors in anomaly patters associated with modes of variability in models. Errors in the mean position of the convergence zones in most models (especially the SPCZ) mean that any model-projected changes in their strength and position could have significant impacts on rainfall projections. Similarly, the westward extension of ENSO-related SST anomalies may mean that changes to the warm pool or similar projections may have reduced or exacerbated temperature and rainfall projections for may small island states (see Brown JN et al. 2012, submitted to Climatic Change). [Brad Murphy, Australia]	Noted, good point. Text will be modified to broaden the discussion and to cite the Brown et al (2012) paper.
14-838	14	54	8	54	8	I pruem you eman the durnal cyle of the Trafe Winds. If so, change to '..height, intensity and diurnal cyle, ..'. If not, the context of diurnal cyle is unclear. [Peter Burt, UK]	No, the reference was to the diurnal cycle generally.
14-839	14	54	13	54	29	This section should also consider islands in the western North Pacific. See "Climate Change in the Pacific: Scientific Assessment and New Research" report by CSIRO and Australian Bureau of Meteorology (2011) for regional and country-specific projections for Palau, Federated States of Micronesia and the Marshall Islands. [Josephine Brown, Australia]	Noted, thanks. Will draw on the new PCCSP report(s).
14-840	14	54	31	55	7	The stength of the southeast trade winds also determines many aspects of the mean climate of south Pacific countries (e.g. rainfall on mountainous islands exposed to the trade winds) and the projected increase in their strength may affect rainfall projections. These rainfall projections will not be reflected in global models due to small-scale topography being missing from even the higher resolution GCMs. [Brad Murphy, Australia]	Noted.
14-841	14	54	39	54	43	Give references for discussion of ENSO influence on SPCZ in South Pacific (e.g. Griffiths et al. 2003; Folland et al. 2003; Climate Change in the Pacific 2011). [Josephine Brown, Australia]	Noted, will add.
14-842	14	54	45	54	46	The mean state of SPCZ does not depend on ENSO. Therefore, the first sentence of this paragraph should be rewritten or removed. [Josephine Brown, Australia]	Noted. Sentence changed to read "Future projections of climate change do not show a clear trend for the ENSO cycle, hence future variability in the SPCZ is uncertain."
14-843	14	54	47	54	49	Widlansky et al. (2011) does not provide projections of future SPCZ changes. Also, there may be a reduction in convergence due to weaker circulation but this may be weaker than the effect of increased moisture, as for the monsoon, where circulation weakens but rainfall increases. Brown et al. (2012) found increased rainfall within the SPCZ in the majority of CMIP3 models in the SH wet season. Does Widlansky find a different result? Further results from CMIP5 models are required here and may assist in clarifying the relative importance of circulation (dynamic) and moisture (thermodynamic) changes. [Josephine Brown, Australia]	Noted, will incorporate.
14-844	14	54	48	54	48	"convergence" [George Kiladis, USA]	Noted - thanks.
14-845	14	54	52	54	53	This sentence needs to be backed up with a reference. [Christian Reuten, Canada]	Will add cross-reference to chapter 12.

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14-846	14	54	52	54	55	This first sentence appears to be inconsistent with other statements in this chapter regarding El Nino-like SST changes. Also, the east-west gradient in SST that is important for the SPCZ is not on the equator but in the South Pacific (around 15S-25S), see Widlansky et al. (2011) and Brown et al. (2012). Meridional SST gradient changes may also be important. [Josephine Brown, Australia]	Noted, disagree. Sense of text seems fine, but will add reference.
14-847	14	55	14	55	14	Refer back to Fig. 14.11 and Chapter 2, Box 2.4 for map of SAM pattern and sign convention. Some of this material on SAM is duplicated in the 14.2.10, consider consolidating. [George Kiladis, USA]	Noted. Will edit this section down to avoid overlap.
14-848	14	55				reference back to 14.2.8.2 and the influence of the PSA would be appropriate [George Kiladis, USA]	Noted - thanks. +H831
14-849	14	56	1	58	31	<p>Following more recent papers should be referred in the BOX 14.3.</p> <p>Murakami H, Wang Y, Sugi M, Yoshimura H, Mizuta R, Shindo E, Adachi Y, Yukimoto S, Hosaka M, Kitoh A, Ose T, Kusunoki S, 2011: Future changes in tropical cyclone activity projected by the new high-resolution MRI-AGCM. J. Climate, in press.</p> <p>Murakami, H., R. Mizuta, and E. Shindo, 2011: Future changes in tropical cyclone activity projected by multi-physics and multi-SST ensemble experiments using 60-km mesh MRI-AGCM. Clim. Dyn. in press.</p> <p>Murakami H, Wang B, Kitoh A 2011: Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model. J Climate 24:1154–1169</p> <p>Murakami, H., and B. Wang, 2010: Future change of North Atlantic tropical cyclone tracks: Projection by a 20-km-mesh global atmospheric model. J. Climate, 23, 2699–2721.</p> <p>Murakami, H. and M. Sugi, 2010: Effect of model resolution on tropical cyclone climate projections. SOLA, 6, 73–76.</p> <p>Sugi M, Murakami H, Yoshimura J, 2009: A reduction in global tropical cyclone frequency due to global warming. SOLA 5:164–167</p> <p>Sugi, M., H. Murakami, J. Yoshimura, 2012: On the mechanism of tropical cyclone frequency change due to global warming. J. Meteor. Soc. Japan, 90A, 399-410.</p> <p>Held, I. M. and M. Zhao, 2011: The response of tropical cyclone statistics to an increase in CO2 with fixed sea surface temperatures. J. Climate, 24, 5353–5364. [Masato Sugi, Japan]</p>	Accepted. These papers have been added to the assessment.
14-850	14	56	3	58	31	The discussion of the remote and local influences on tropical Atlantic hurricanes and storms by Smith et al (2010) should be included in Box 14.3: Smith, D. M., R. Eade, N. J. Dunstone, D. Fereday, J. M. Murphy, H. Pohlmann, and A. A. Scaife (2010): Skilful multi-year predictions of Atlantic hurricane frequency. Nautre Geoscience, doi:10.1038/ngeo1004. [Christopher Folland, United Kingdom of Great Britain & Northern Ireland]	Rejected. This is certainly an important paper, but it is not clear where the main results would be relevant here. The notion of local and remote influences on hurricanes is not new while the more original result that these influences may operate on longer than seasonal timescales is not highly relevant to this Box. However, this paper may be more relevant to the hurricane related section in Ch. 2, and we will try to coordinate with them about possible addition there.
14-851	14	56	5	56	5	This is a well written summary. It is rather long, and duplicates some material already covered in Sections 2.7.3, 10.6.1.5 and 11.4.2.5.3. Consider merging this information into one place to save space. There should at least be cross referencing between these sections. [George Kiladis, USA]	Noted and accepted. We are working with Chapters 2 and 10 to improve our cross-referencing and reduce duplication.
14-852	14	56	5	58	31	Extremely confusing [VINCENT GRAY, NEW ZEALAND]	Noted. We feel that it is not extremely confusing.
14-853	14	56	5	58	31	Ramaswamy et al., Science (2011) reported that anthropogenic aerosols from Indian subcontinent influence the intensity of tropical cyclone. [S K Satheesh, India]	We believe that this reference should in fact be Evan et al. (Nature, 2011), which is already included.

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14-854	14	56	7	56	9	Please consider adding the reference : Lam H., M.H. Kok and K.Y. Shum, 2012 : Benefits of Typhoon - the Hong Kong Perspective, accepted for publication in "Weather". [Tsz-cheung Lee, Hong Kong]	Noted with thanks. The citation has been added.
14-855	14	56	20	56	37	Relation between TC track and frequency of occurrence is discussed in Murakami and Wang (2010) J. Clim. 23, 2699–2721 and Murakami et al.(2011) J. Clim. 24, 1154–1169. They argue that the contribution of TC track change to TC frequency of occurrence change is smaller than that of genesis change. The anthropogenic signal in TC track variation is generally much smaller than the natural variability. [Masato Sugi, Japan]	Noted. The section and references are all based on observed relationships, while the references suggested here are based on model projections. We feel that the two should be kept separated.
14-856	14	56	26	56	26	A new southern hemisphere example has become available: Callaghan and Power (Climate Dynamics, 2011). They show that landfalling severe tropical cyclones over northeastern Australia are modulated by ENSO. Recommend adding Callaghan and Power (2010) to list of citations on line 26. [Scott Power, Australia]	Rejected. We can, and will, add this to another section, but here we are very specifically discussing papers that show track variability linked to other modes of variability, and not simply relationships in general. One would need to show that the landfalling variability is due to variability of tracks and not basin-wide frequency.
14-857	14	56	35	56	35	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected. The meaning of anthropogenic is what is intended in this context.
14-858	14	56	47	56	49	The text states that: "there is only low confidence that any reported long-term increases in tropical cyclone activity are robust". However, this sentence was written without taking a new study by Callaghan and Power (Climate Dynamics, 2011) into account. In this study a downward trend in the number of severe tropical cyclones making landfall over north-eastern Australia since the late 19th century is identified. The trend is shown to be statistically significant at the 90% level. The authors conclude that the data are robust and suitable for trend analysis. This is based on their findings that e.g.: (i) the record exhibits a Poisson distribution (consistent with shorter satellite records of TC frequency); (ii) the variance in the first part of the record is the same as variance in the second part of the record; (ii) there is an ENSO imprint on the variability consistent with shorter satellite-based records; and (iv) the trend coincides with a trend in the SOI over the same period, and is therefore plausible. (continued in next row) [Scott Power, Australia]	We agree that the text in the Executive Summary needed to be modified because there we used the expression "reported trends". But here, we are using the word "detected" which needs to conform to the specific meaning in an IPCC document. As inferred in the Callaghan and Power paper, it is not clear whether this trend is detectable because the expected natural variability has not been quantified. Furthermore, as with all studies of landfall frequency, it cannot provide information about basinwide trends because the landfall variability may be due entirely to track changes while basinwide statistics remain constant over time. This is not meant to suggest that the Callaghan and Power paper is not important, and we have added text to be more inclusive of those results.
14-859	14	56	47	56	49	continued from previous row: (v) in the unlikely event that tropical cyclones were in fact missed these would have occurred in the early part of the record and so their inclusion would therefore increase the magnitude of the downward trend. Given the reliability of the data, the statistical significance of the trend and the fact that the dataset provides the longest available record of tropical cyclone/hurricane activity in the Southern Hemisphere and one of the longest in the world, I recommend that the statement above is modified to: "While there has been a downward trend in the number of severe tropical cyclones making landfall over north-eastern Australia since the late 19th century, there is only low confidence in the robustness of reported long-term increases in tropical cyclone activity in other locations". [Scott Power, Australia]	See reply to comment 14-858
14-860	14	57	1	57	4	I suggest rewording this to say something like: "Since current projections of 21st century tropical SST change tend to show relative SST changes (i.e., regional average changes relative to the tropical mean) that are smaller than the magnitude of the regional SST warming, this recent research suggests that increasing SST due to greenhouse warming, by itself, does not yet have a fully understood physical link to increasingly strong tropical cyclones." [Thomas Knutson, U.S.A.]	Accepted. The text has been modified.
14-861	14	57	11	57	11	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas	Rejected. The meaning of anthropogenic is what is

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						Watson, Australia]	intended in this context.
14-862	14	57	15			add cite to Villarini et al. here. Ref: Villarini, G., G. A. Vecchi, T. R. Knutson, M. Zhao, and J. A. Smith, 2011: North Atlantic tropical storm frequency response to anthropogenic forcing: Projections and sources of uncertainty. Journal of Climate, 24(13), doi:10.1175/2011JCLI3853.1. [Thomas Knutson, U.S.A.]	Accepted. Reference has been added.
14-863	14	57	17	57	27	In this paragraph, there are two contradictory statements on the frequency of future tropical cyclones. It is understood that these contradictory results are caused by resolution differences and might also be related to processes that have yet to be found. It would be better to rearrange the paragraph, though, to contrast the two contradictory findings. [Christian Reuten, Canada]	Accepted in part. The issue here is not resolution differences, but rather greater disagreement among models when the area of interest is reduced from all basins (global) to a single basin (regional). The greater disagreement leads to greater uncertainty. We have modified the text slightly to be more clear on this point.
14-864	14	57	17	57	27	Two major source of inter-model difference are the pattern of SSTA used in the experiment and the model physics (particularly the convection scheme). Murakami et al (2012) J. Climate (in press) show by ensemble experiments that the impact of SSTA difference is much larger that of model physics. Sugi et al. (2009) SOLA 5:164–167 also show that the regional TC frequency change is sensitive to the pattern of SSTA. [Masato Sugi, Japan]	Noted.
14-865	14	57	20	57	21	The likely here refers to the sign of the change. The ranges refer to the range spanned by the models that were included in the Knutson et al. Review paper. We should be careful not to interpret those ranges as "likely ranges" in the sense of confidence intervals. [Thomas Knutson, U.S.A.]	Noted. The range values have been removed to avoid confusion.
14-866	14	57	24	57	27	"Still, high-resolution modelling studies typically project" : it is suggested that non-hydrostatic global model plays a role in increasing confidence in this statement . Reference: Yamada et al. 2010, GRL doi:10.1029/2010GL042518 [KAZUYOSHI OOUCHI, JAPAN]	Noted with thanks. The citation has been added and the text has been modified to include this.
14-867	14	57	29	57	29	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Rejected. The meaning of anthropogenic is what is intended in this context.
14-868	14	57	48	57	48	Similar results were obtained by Mori (2012) and they investigated tropical cyclone genesis shift to center of ocean basin in the North Western Pacific, North Eastern Pacific and North Atlantic ocean. Mori, N. (2012) Projection of Future Tropical Cyclone Characteristics based on Statistical Model, In Cyclones Formation, Triggers and Control, Eds. K.Oouchi and H.Fudeyasu, Chapter 12, Nova Science Publishers, 24p., in press. [Nobuhito Mori, Japan]	Noted. It is not clear where to obtain a copy of this, nor is it clear that this constitutes a peer-reviewed document. Since it's inclusion doesn't change our assessment, and this is not intended to be a literature review, we have chosen not to include this.
14-869	14	57	50	58	6	Please consider including the findings of Murakami and Sugi (2010) on the effect of model resolution on projected climatological features of tropical cyclones (TCs). By using four resolutions ranging from 180-km mesh to 20-km mesh, they found that the finest resolution model showed the highest skills in terms of TC intensity and inter-annual and seasonal variations in TC genesis number. Projections with model resolution at 60-km and finer show a significant increase in the frequency of intense TCs in the future. They also projected significant reductions in the TC genesis number in the future in most of the basins, including the WNP. Reference : - Murakami, H. and M. Sugi, 2010: Effect of model resolution on tropical cyclone climate projections, SOLA, 6, 73-76. [Tsz-cheung Lee, Hong Kong]	Accepted. Text has been added/modified to include this. .
14-870	14	57	50	58	6	Please consider including the findings of Li et al. (2010). By using 40 km resolution global model, their study projected a significant shift in the location of tropical cyclones from the western to central Pacific in the 21st century. Tropical cyclone genesis number decreases significantly in the western Pacific but increases remarkably in the central Pacific. Reference : - Li, T., M. H. Kwon, M. Zhao, J. S. Kug, J. J. Luo, and W. D. Yu, 2010: Global warming shifts Pacific tropical cyclone location, Geophys. Res. Lett., 37, L21804, doi:10.1029/2010GL045124. [Tsz-cheung Lee, Hong Kong]	Accepted. Text has been added/modified to include this. .
14-871	14	57	50	58	6	Please include more detailed discussions on the projections of tropical cyclone activity for other basins, especially the western North Pacific. In 2009, the ESCAP/WMO Typhoon Committee formed an expert team	Accepted. We are including new tables and discussions that address the various basins.

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						to assess the impacts of climate change on frequency and intensity in the Western North Pacific and the South China Sea. The first assessment report has been published in 2010. On tropical cyclone projections in the western North Pacific, most of the climate model studies project a reduction in the number of tropical cyclones in the western North Pacific in the 21st century. While there are fewer studies on the change of tropical cyclone intensity, some of the model projections suggest an increase in the number of intense tropical cyclones in the region in a warmer climate. Please also note that the ESCAP/WMO Typhoon Committee has also tasked an expert team to conduct the second assessment on the impact of TC activity in the Typhoon Committee region with a focus on the possible changes in TC track and impact areas, including landfalling statistics/trends. More updated summaries on the projections on the tropical cyclone frequency, intensity and precipitation in the western North Pacific will be incorporated in the 2nd assessment report which will be published later in 2012. References : - Lee, T.C., W.J. Lee, T. Nakazawa, J.C. Weyman, and M. Ying, 2010: Assessment report on impacts of climate change on tropical cyclone frequency and intensity in the Typhoon Committee region, ESCAP/WMO Typhoon Committee, TC/TD-No. 0001. - Lee, T.C., 2012 : A review on the long term variations of tropical cyclone activity in the Typhoon Committee Region, to be published in the Tropical Cyclone Research and Review. [Tsz-cheung Lee, Hong Kong]	
14-872	14	57	50	58	6	Resemblance of global warming SSTA pattern with that of El Nino does not necessarily mean that it is caused by the change in the behavior of ENSO. [Masato Sugi, Japan]	Noted.
14-873	14	57	52	58	3	Please state whether these part of description is referring to western North Pacific tropical cyclone activity. [Tsz-cheung Lee, Hong Kong]	Accepted. Text has been added/modified to clarify this. .
14-874	14	58	1	58	6	Should discuss the new Murakami et al. results in this section. [Thomas Knutson, U.S.A.]	Accepted. Discussion has been added.
14-875	14	58	8	58	15	Ensemble experiments are effective way to increase the signal to noise ratio. Ensemble mean can provide a more reliable projection. See Murakami et al. (2012) Climate Dyn. (in press) [Masato Sugi, Japan]	Noted.
14-876	14	58	23	58	25	Low confidence in any reported regional trends in TC activity on multidecadal timescales or greater? What about the US landfalling hurricane record? [Thomas Knutson, U.S.A.]	Accepted. We have expanded the text to include landfalling records for the Atlantic as well as the Australian region.
14-877	14	58	23			Too much emphasis on ENSO here. There are other issues to confront as well: tropical lapse rates, wind shear changes in various regions, relative SST in the Atlantic basin, etc. [Thomas Knutson, U.S.A.]	Accepted. Text has been added/modified.
14-878	14	58	38	61	16	Also extremely confusing [VINCENT GRAY, NEW ZEALAND]	The Box is carefully written and we do not agree with this statement.
14-879	14	58	41	58	41	ETCs are no features of weather maps, but features of the real world. [Matthias Zahn, United Kingdom]	Accepted - changed to simply mid-latitude weather.
14-880	14	58	42	58	42	Space between number and unit. [Peter Burt, UK]	Editorial. Accepted.
14-881	14	58	47	58	47	change ", not only are they responsible" with ": they are" [ANNALISA CHERCHI, Italy]	Accepted - changed to 'not only do they constitute'.
14-882	14	58	48	58	48	change "but" with "and" [ANNALISA CHERCHI, Italy]	Rejected - "but" is the correct meaning here.
14-883	14	58	52	58	52	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	The word is not used in this line of text
14-884	14	59	13	59	17	it would be good to verify this statement with a reference (or figure) [Matthias Zahn, United Kingdom]	Accepted - have added citation to AR4.
14-885	14	59	16	59	16	Space between number and unit. [Peter Burt, UK]	Editorial. Accepted.
14-886	14	59	42			"debated" should be replaced with "discussed", because debate is not an acceptable scientific mode of communication. [Christian Reuten, Canada]	Accepted.
14-887	14	60	22	60	22	reference is Catto et al, 2011 [Matthias Zahn, United Kingdom]	Accepted.

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14-888	14	60	32	60	32	Ambiguous phrasing, what does a 'strengthening of the storm track' mean? More storms, more storms with higher wind speeds ? [Matthias Zahn, United Kingdom]	Accepted - changed to 'comprising instead an increase in storm activity and a downstream extension of the storm track into Europe'. The ambiguity arises because some of the papers use filtered variances to define the storm track and so these do distinguish
14-889	14	61	2	61	2	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-890	14	61	20	62	21	In FAQ 14.1 I think it would be relevant to mention potential responses to heterogeneous radiative forcing caused by short-lived climate forcers; e.g. black carbon, sulphate. [Jan Fuglestedt, NORWAY]	Maybe, but not in the spirit of the chapter. No change made.
14-891	14	61	20	62	48	There is a much more plausible relationship between the two from the various "phenomena that have been described, than any relationship with the energy exchange models that you favour. The wind and ocean movements move over many regions, the energy exchanges do not. [VINCENT GRAY, NEW ZEALAND]	No change. Winds and ocean currents are what effect the exchanges of energy.
14-892	14	61	28	61	28	change "So too" with "Consequently" [ANNALISA CHERCHI, Italy]	Changed to "For similar reasons..."
14-893	14	61	30	61	30	change "variation" with "details" [ANNALISA CHERCHI, Italy]	No change. Prefer original wording.
14-894	14	61	46	61	46	Sea-ice [Matthias Zahn, United Kingdom]	Done
14-895	14	61	54	61	54	remove "cycle" [ANNALISA CHERCHI, Italy]	Done
14-896	14	61				FAQ 14.1: Suggest to begin with global changes (why these are important and how they can inform regarding expected changes at the regional scale), before going into how and why global changes are felt differently at the regional scale. [Thomas Stocker/ WGI TSU, Switzerland]	Have moved the text in this direction.
14-897	14	61				FAQ 14.1: We suggest a compelling figure in the context of this FAQ would be one that shows the regional patterns in scaling of changes in extreme temperatures relative to mean global temperature change. See for example, figures 9 and 10, from the Orłowsky and Seneviratne 2012 Climate Change paper. [Thomas Stocker/ WGI TSU, Switzerland]	Good suggestion. I am not that taken with the figures from Orłowsky and Seneviratne, but have generated a composite graphic.
14-898	14	62	4	62	5	The future of ENSO depends on many other factors than "the details of the upper-ocean warming across the tropical Pacific" (cf Collins et al. Nature Geoscience 2010) [Eric Guilyardi, France]	Changed to read "The future of the ENSO cycle remains uncertain, because its behaviour will depend upon how the oceanic and atmospheric circulations evolve across the tropical Pacific. The details of such evolution, however, are not consistently represented in current climate models."
14-899	14	62	12	62	12	anthropogenic The term should never be used in this contexts, say 'changed weather conditions (1) [Thomas Watson, Australia]	Disagree. We are referring to an anthropogenic origin here
14-900	14	62	16	62	19	FAQ14.1, figure 1: are they composite of SOI? which time period? why the signal in the IO is missing? [ANNALISA CHERCHI, Italy]	Figure changed, and method/units explained in caption.
14-901	14	62	28	62	32	Other factors affecting the strength of the monsoon should be listed as clear as possible. For Asian monsoon, large-scale topography plays a important role and this point should be clarified. For more details see:Duan, A. M. & Wu, G. X. 2005: Role of the Tibetan Plateau Thermal Forcing in the Summer Climate Patterns over Subtropical Asia. Clim. Dyn. 24, 793-807. DOI 10.1007/s00382-004-0488-8. [Anmin Duan, China]	Text has been extensively modified and the role of topography is now included.
14-902	14	62	37	62	38	"A number of studies indicate a trend towards heavier monsoon rains in the main tropical monsoon regions, with a large increase in the frequency of extreme rainfalls.". Are these observational studies? [David Parker, United Kingdom of Great Britain & Northern Ireland]	Text has been extensively modified. Refer back to main text for references.
14-903	14	62	39	62	39	" e.g., parts of western India" may be written as "along the west coast of India" [Madhavan Nair RAJEEVAN, India]	Text removed/modified

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14-904	14	62	48	62	48	at the end add the following "Futhermore according to the local characteristics the monsoons may be mainly driven by changes in moisture(Asian-Australian monsoons) rather than by changes in pure dynamical properties (other monsoon system like in South America, West Africa and North America). [ANNALISA CHERCHI, Italy]	Text modified to help balance the discussion of drivers.
14-905	14	62				FAQ 14.2: The response to this FAQ needs to be considerably expanded and broadened. The FAQ is phrased such that the authors should also address observed changes in monsoons (i.e., how has climate affected monsoons over recent decades), including some discussion regarding the detection and attribution of these changes, before proceeding with the discussion of how climate change is expected to effect monsoons in the future. [Thomas Stocker/ WGI TSU, Switzerland]	Text has been extensively modified. No discussion of D&A as little in the literature or body of the chapter.
14-906	14	62				FAQ 14.2: Regarding the projected changes: The current wording used in the italicized text seems contradictory and needs to be clarified, i.e., Changes in monsoon intensity and area "are likely in many regions", seem to contradict the statement that "monsoon circulations are expected to considerably weaken". Please also note the general comment regarding the avoidance of the formal IPCC uncertainty terminology in FAQs. [Thomas Stocker/ WGI TSU, Switzerland]	Text has been extensively modified.
14-907	14	62				FAQ 14.2: For the body of the FAQ response, we would suggest the authors consider using the following general structure; 1) a discussion of the observed regional changes in monsoon circulation, timing, rainfall, 2) a discussion of the understanding (and uncertainties) regarding the causes of these changes, 3) a discussion of the projected regional changes in monsoon circulations, timing, rainfall and the causes (e.g., how will regional aerosol loading influence future monsoon characteristics). [Thomas Stocker/ WGI TSU, Switzerland]	FAQ modified essentially along these lines.
14-908	14	62				FAQ 14.2: We would strongly encourage the use of compelling figure to support this FAQ. Options could include a schematic figure illustrating the climatic factors that can/will influence monsoon characteristics, or a more quantitative figure showing projected precipitation changes within the monsoon influenced regions. [Thomas Stocker/ WGI TSU, Switzerland]	Thanks - working on it. A schematic has been put in.
14-909	14	63	1	89	70	Many references are not complete, vol no or page nos are missing [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-910	14	65	39	65	39	In the reference list, name of journal is missing from Bueh & Nakamura paper. [Andrey Shmakin, Russia]	Editorial - will be managed
14-911	14	65	39	65	39	In the reference list, name of journal is missing from Bueh & Nakamura paper. [Andrey Shmakin, Russia]	Same as above
14-912	14	67	50	67	51	PI include DOI for Dash et al. 2009, 10.1029/2008JD010572 [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-913	14	69	1	69	4	The refrence of Evan et al is repeated. PI retain the second reference and delete the first reference. [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-914	14	69	35	69	36	Add "Nature Geoscience,3, " before the page numbers. [Christian Reuten, Canada]	Editorial - will be managed
14-915	14	71	29	71	32	The reference of Hendon et al. is repeated. [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-916	14	72	21	72	24	It looks like the same paper (Hurrell & Deser) is cited twice, with different publication year and pages. [Andrey Shmakin, Russia]	Editorial - will be managed
14-917	14	72	21	72	24	It looks like the same paper (Hurrell & Deser) is cited twice, with different publication year and pages. [Andrey Shmakin, Russia]	Same as above
14-918	14	72	54			What's up with the reference that has only the initials of the authors? I have no idea of whether or where this is referenced in the text. [Brent Lofgren, USA]	Editorial - will be managed
14-919	14	73	14			Journal name is missing: Hydrological Research Letters and the last author name is a group name which cannot be abbreviated. The correct citation information is as follows:Akio Kitoh, Tomoaki Ose, Kazuo Kurihara, Shoji Kusunoki, Masato Sugi and KAKUSHIN Team-3 Modeling Group: Projection of changes in future weather extremes using super-high-resolution global and regional atmospheric models in the KAKUSHIN Program: Results of preliminary experiments, Hydrological Research Letters, Vol. 3, pp.49-53, (2009) [Tosiyuki Nakaegawa, Japan]	Editorial - will be managed

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14-920	14	74	8	74	8	Journal of the Meteorological Society of Japan. 247-258. ----> Journal of the Meteorological Society of Japan, 84, 247-258. [Shoji Kusunoki, Japan]	Editorial - will be managed
14-921	14	74	13	74	13	Journal of Geophysical Research-Atmospheres, 116, ----> Journal of Geophysical Research-Atmospheres, 116, D06105, 21 PP., doi:10.1029/2010JD014920. [Shoji Kusunoki, Japan]	Editorial - will be managed
14-922	14	74	15			Journal name is missing: Hydrological Research Letters, and the second author name is "M. Nakano". [Tosiyuki Nakaegawa, Japan]	Editorial - will be managed
14-923	14	74	23	74	24	Replace "and a. others" with "et al." and add ", D16105" at the end. [Christian Reuten, Canada]	Editorial - will be managed
14-924	14	74	33	74	34	Use all listed author initials in citation: Knight, J.R., Allan, R.J., Folland, C.K., Vellinga, M., Mann, M.E., A Signature of Persistent Natural Thermohaline Circulation Cycles in Observed Climate, Geophysical Research Letters, 32, L20708, doi: 10.1029/2005GL02423, 2005 [Michael Mann, USA]	Editorial - will be managed
14-925	14	75	6	75	6	Following reference could be added "Kripalani, R.H., et al., 2010: Delayed influence of the Indian Ocean Dipole Mode on the East Asia-West Pacific Monsoon. International Journal of Climatology, 30, 197-209 [Ramesh Kripalani, India]	Editorial - will be managed
14-926	14	75	16	75	17	For the reference of Kucharski et al, add the following details, L03709, doi:10.1029/2005GL025371. [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-927	14	75	45	75	46	Insert the following reference between line 45 and 46; Kusunoki, S., and O. Arakawa, 2011: Change in the precipitation intensity of the East Asian summer monsoon projected by CMIP3 models. Clim. Dyn. doi: 10.1007/s00382-011-1234-7 [Shoji Kusunoki, Japan]	Editorial - will be managed
14-928	14	75	45	75	46	Insert the following reference between line 45 and 46; Kusunoki, S., and R. Mizuta, 2008: Future Changes in the Baiu Rain Band Projected by a 20-km Mesh Global Atmospheric Model: Sea Surface Temperature Dependence. Scientific online Letters on the Atmosphere (SOLA), 4, 85-88. doi:10.2151/sola 2008-022 [Shoji Kusunoki, Japan]	Editorial - will be managed
14-929	14	75	45	75	46	Insert the following reference between line 45 and 46; Kusunoki, S., J. Yoshimura, H. Yoshimura, A. Noda, K. Oouchi, and R. Mizuta, 2006: Change of Baiu rain band in global warming projection by an atmospheric general circulation model with a 20-km grid size. J. Meteor. Soc. Japan, 84, 581-611. doi:10.2151/jmsj.84.581 [Shoji Kusunoki, Japan]	Editorial - will be managed
14-930	14	75	45	75	46	Insert the following reference between line 45 and 46; Kusunoki, S., R. Mizuta and M. Matsueda, 2011: Future changes in the East Asian rain band projected by global atmospheric models with 20-km and 60-km grid size. Climate Dynamics, doi:10.1007/s00382-011-1000-x [Shoji Kusunoki, Japan]	Editorial - will be managed
14-931	14	78	18	78	21	Mann and Emanuel [2006] is listed redundantly as two references [2006a and 2006b] [Michael Mann, USA]	Accepted with thanks. We will fix this.
14-932	14	80	11	80	12	The complete citation of Murakami et al. 2011 should be : Murakami, H., B. Wang, and A. Kitoh, 2011: Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model. J. Climate, 24, p1154-1168. [Tsz-cheung Lee, Hong Kong]	Accepted.
14-933	14	82	1	82	2	10.1029/2007GL031613 [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-934	14	82	1	82	2	for the reference of Ramesh and Goswami, pl add DOI, 10.1029/2007GL031613 [Madhavan Nair RAJEEVAN, India]	Editorial - will be managed
14-935	14	90	4	93	3	As presented they are all out of date and will hopefully be replaced by the up-to-date versions [VINCENT GRAY, NEW ZEALAND]	Agreed. This is also stated. The table is a placeholder for SOD
14-936	14	90		93		In my opinion, the contents of the table is too confused and difficult to understand. I do not get to make an alternative proposal but I think a relief effort is needed. May create sub-regional tables? [bouraima YABI, Benin]	The format and content of this table will be revised
14-937	14	90				Table 14.1: Chapter 12 also has a table of regional temperatures so overlap needs to be discussed [Julie	This is sorted out between Chpater 12 and 14

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						Arblaster, Australia]	
14-938	14	96	1			Two request regarding the figure, if possible: First, swap orange and blue, because psychologically, blue is associated with a decrease while red and orange would be associated with an increase. Second, the outlines of current GMA is difficult to identify over some areas; fine hashing or a semi-transparent fill would be very helpful. On a technical note, is it realistic that the blue area of future increase over the Pacific just east of northern South America is disconnected from the current GMA? [Christian Reuten, Canada]	The format and content of this table will be revised
14-939	14	96				Fig.14.1: I am surprised to see monsoon regions in the extratropics, especially in the current climate of Canada. Maybe the definition of what a mosoon is (a tropical feature) in section 14.2.2 should be modified. [Matthias Zahn, United Kingdom]	Consistency of the definitions will be assured
14-940	14	97				Fig 14.2: How robust are these displayed trends? Please explain. [Thomas Stocker/ WGI TSU, Switzerland]	The figure is revisited in the view of the overall need for more and improved figures.
14-941	14	98				Fig.14.3: please add to the caption that the unit is degrees Celsius or Kelvin [Matthias Zahn, United Kingdom]	Editorial, will do
14-942	14	99				Fig 14.4: Why is RCP6 singled out here? [Thomas Stocker/ WGI TSU, Switzerland]	This has not been thought through. The figure will be taking other RCPs on board, if kept
14-943	14	100	5			"he JAS(1)"? [Christian Reuten, Canada]	Editorial, will check and update
14-944	14	105				Fig.14.10: add units! [Matthias Zahn, United Kingdom]	Editorial, will do
14-945	14	106	8			How was the long-term trend calculated? [Christian Reuten, Canada]	Editorial, this will be added to the explanation
14-946	14	106	8			Fig.14.11, seems to me the black line is the running mean rather than the long-term trend [Matthias Zahn, United Kingdom]	Will be double cheked