



# From IPCC AR5 to AR6

Panmao Zhai

IPCC WGI

Key SPM Messages

# 19 Headlines

on less than 2 Pages

Summary for Policymakers  
ca. 14,000 Words

14 Chapters,  $>10^6$  Words  
Atlas of Regional Projections

54,677 Review Comments  
by 1089 Experts

2010: 259 Authors Selected

2009: WGI Outline Approved

ipcc

INTERGOVERNMENTAL PANEL ON climate change

## CLIMATE CHANGE 2013

*The Physical Science Basis*

WG I

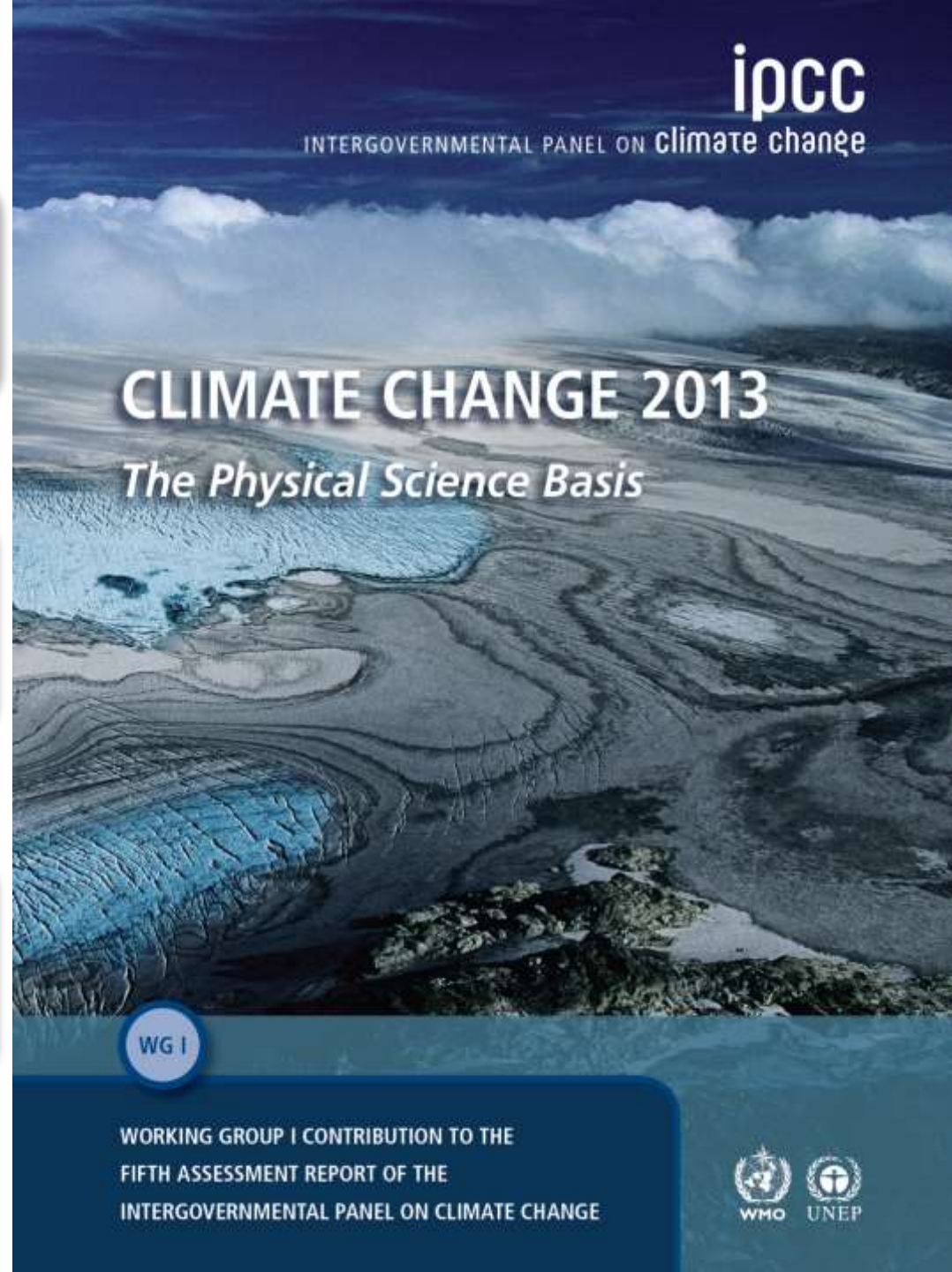
WORKING GROUP I CONTRIBUTION TO THE  
FIFTH ASSESSMENT REPORT OF THE  
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

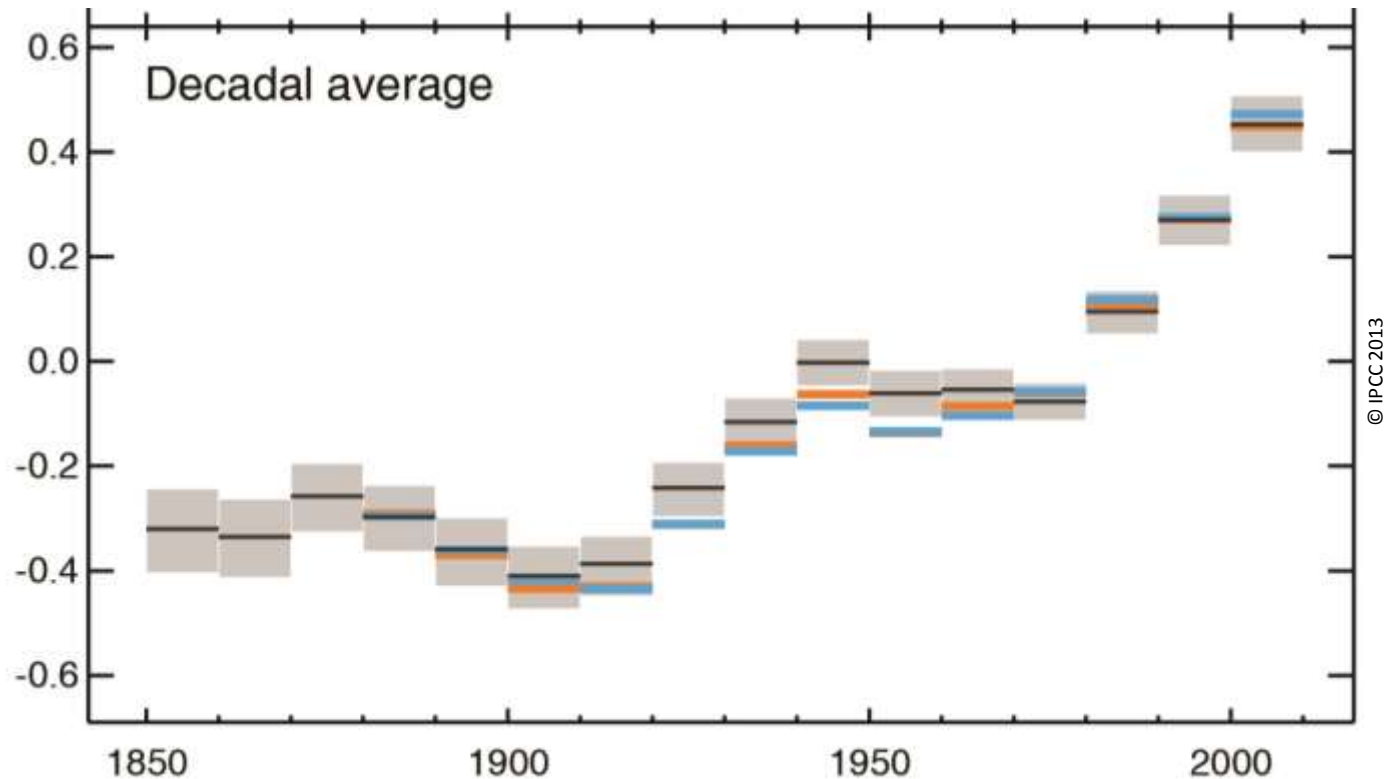


Observation

Understanding

Future

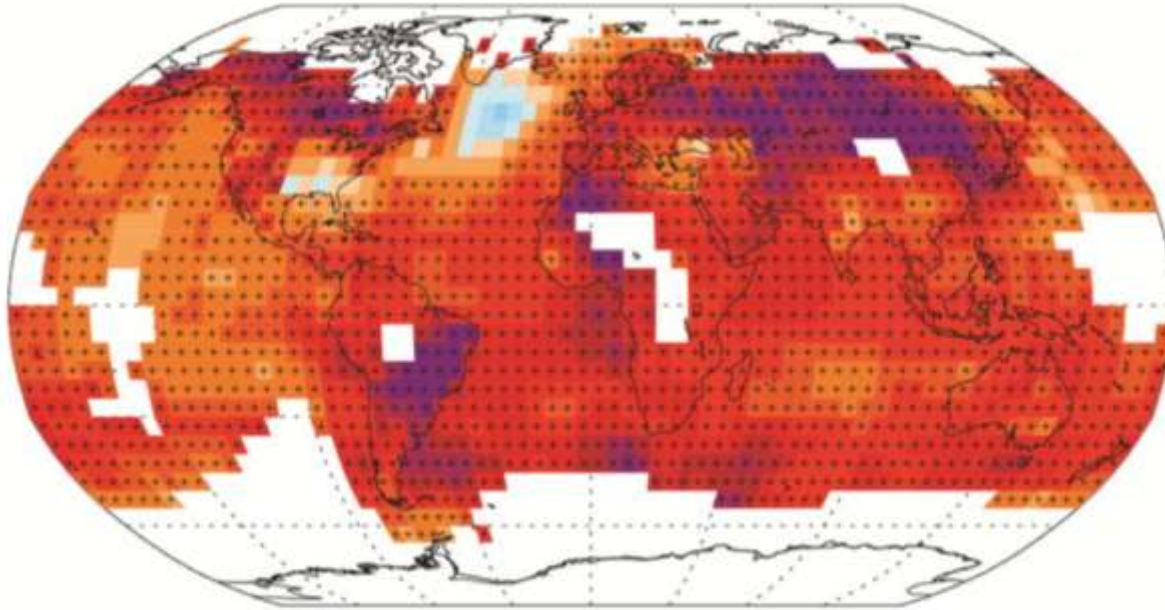




Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850.

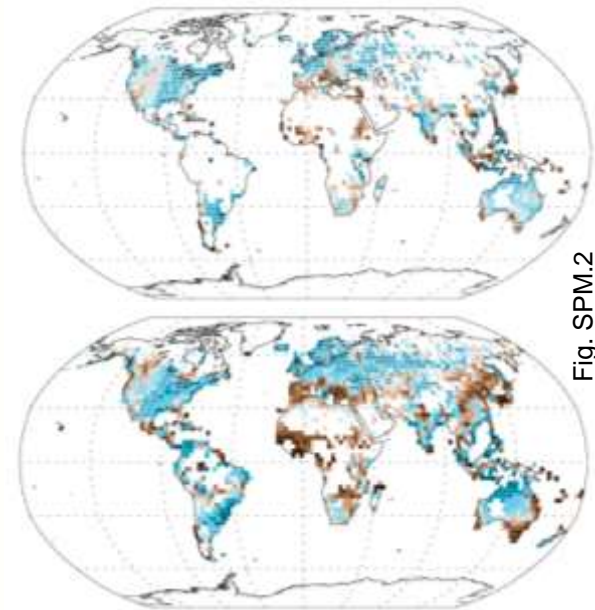
In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-year period of the last 1400 years (*medium confidence*).

© IPCC 2013



Temperature Difference 1901 to 2012 based on trend (°C)

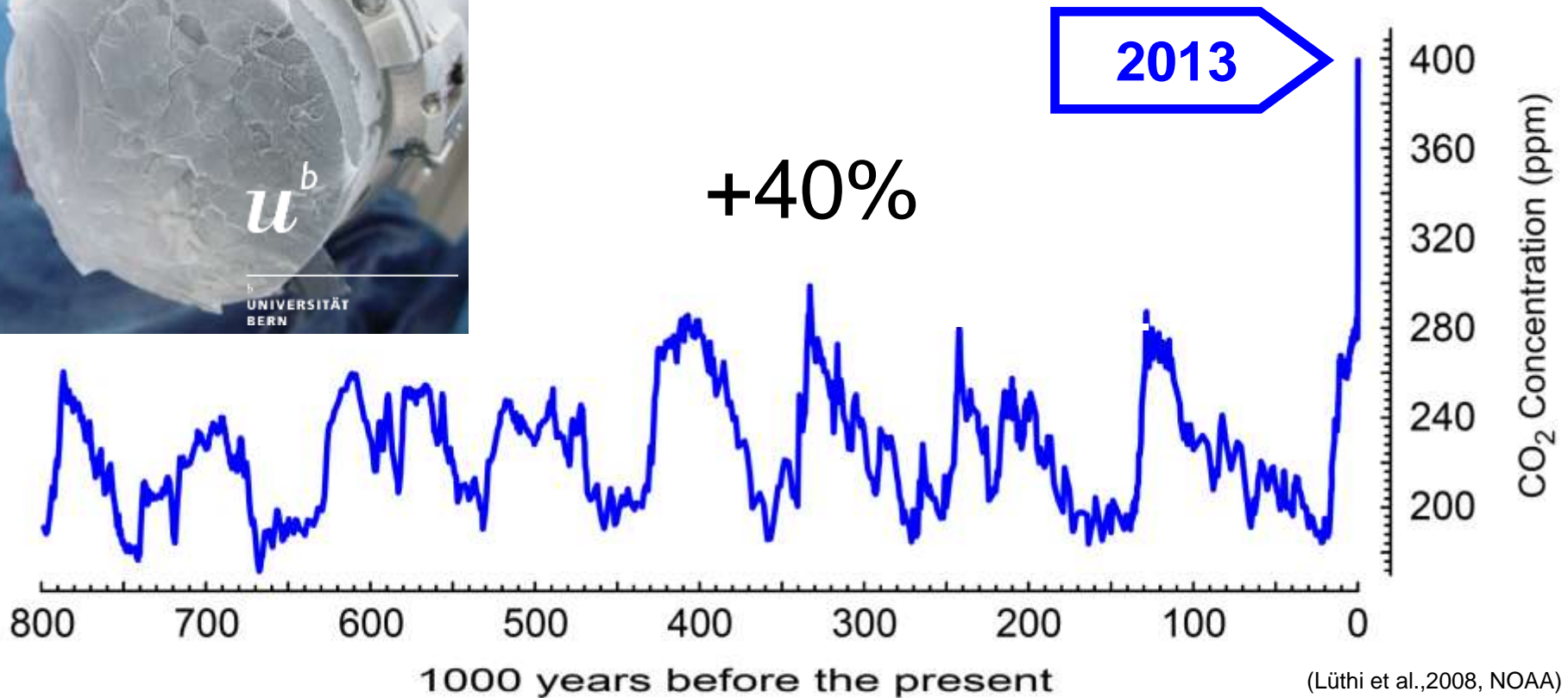
© IPCC 2013



Precipitation Trend (mm/yr per decade)

Fig. SPM.2

Warming of the climate system is unequivocal, [...]



The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.

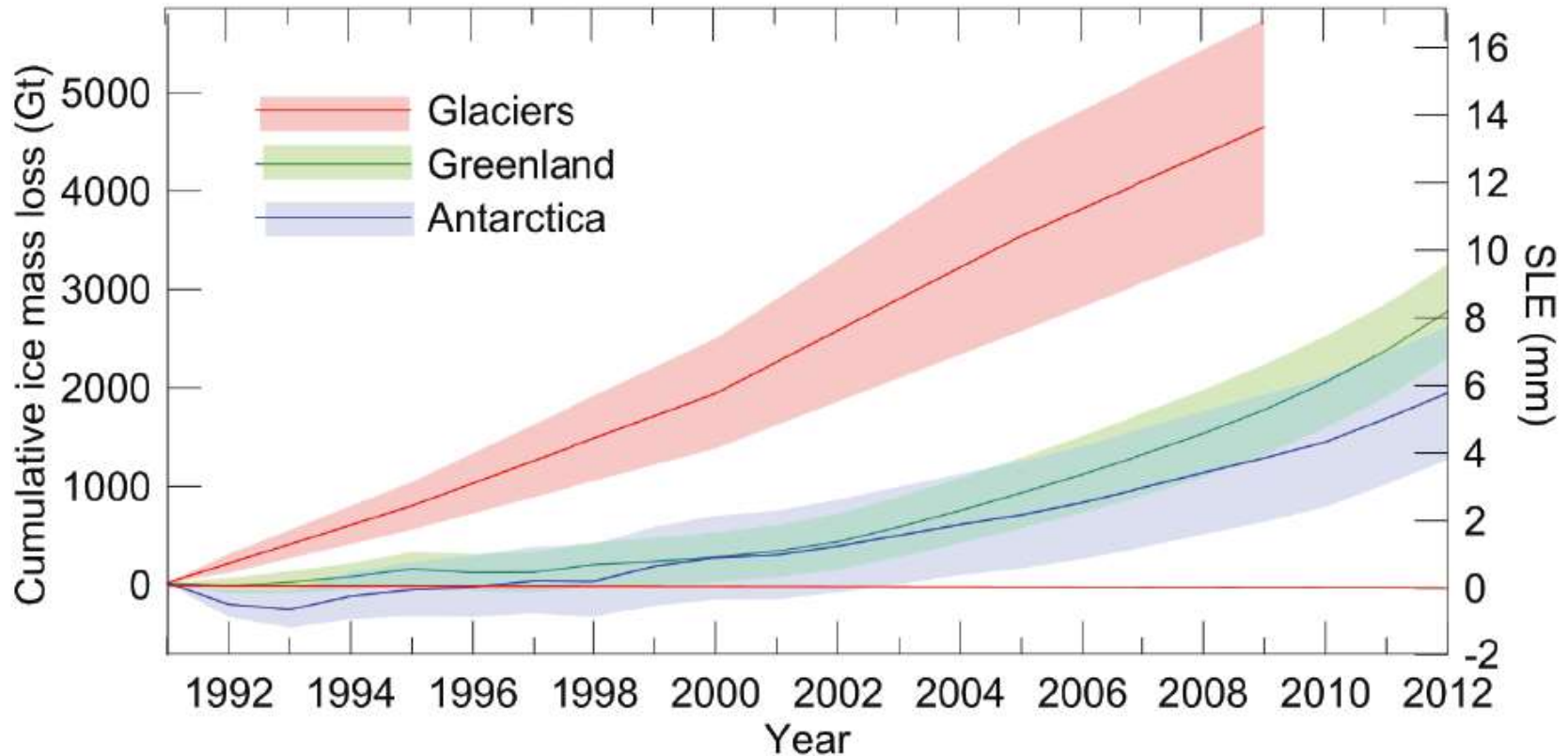
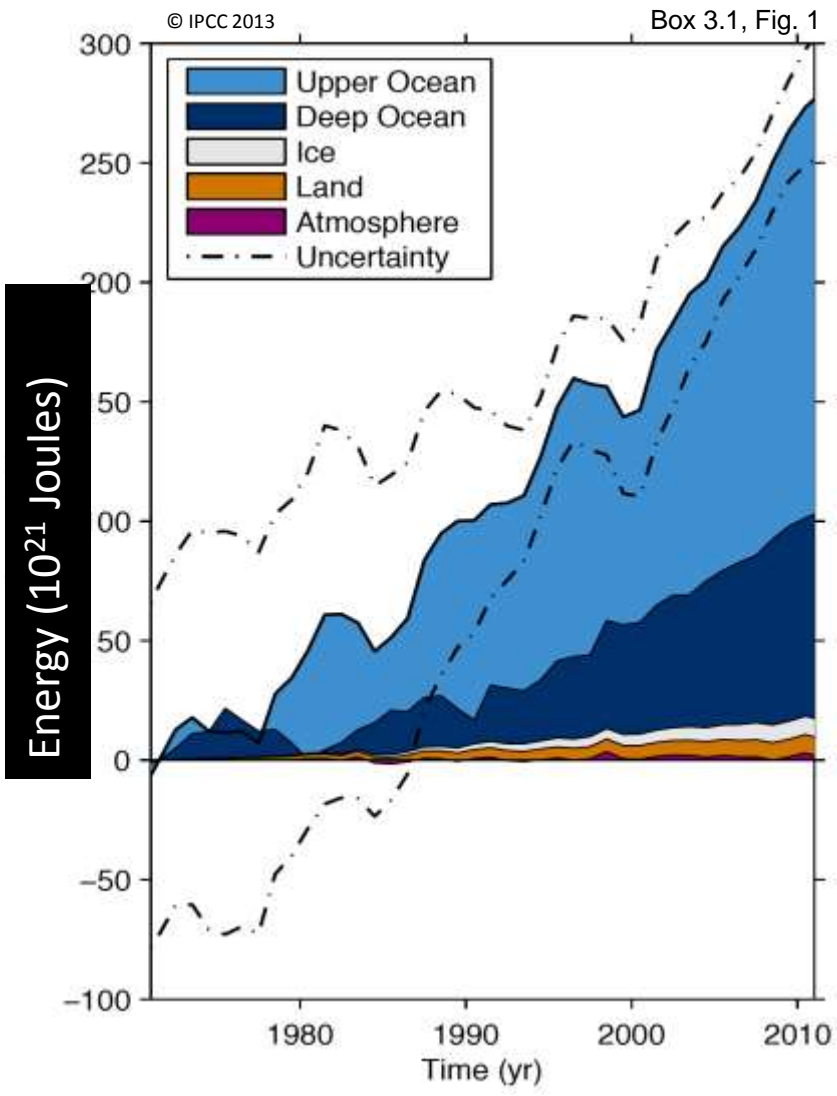


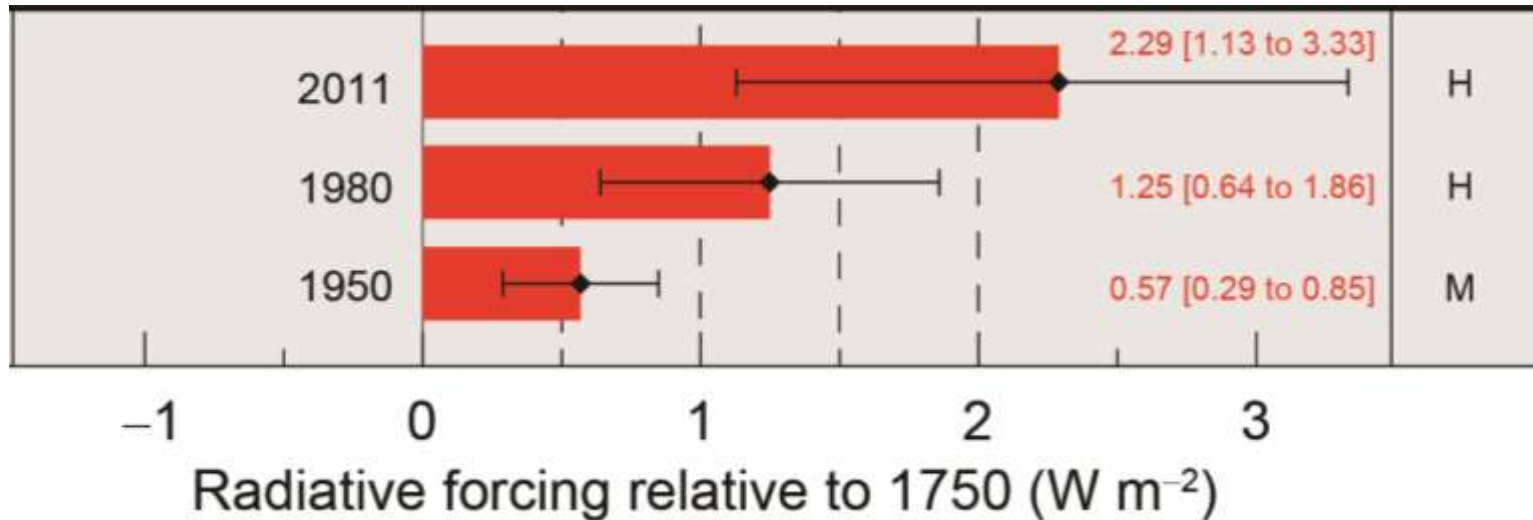
Fig. TS.3

Ice loss from	Glaciers	226 ( $\pm 60\%$ ) Gt yr <sup>-1</sup>	(1993-2003)
	Greenland	215 ( $\pm 25\%$ ) Gt yr <sup>-1</sup>	(2002-2011)
	Antarctica	147 ( $\pm 50\%$ ) Gt yr <sup>-1</sup>	(2002-2011)

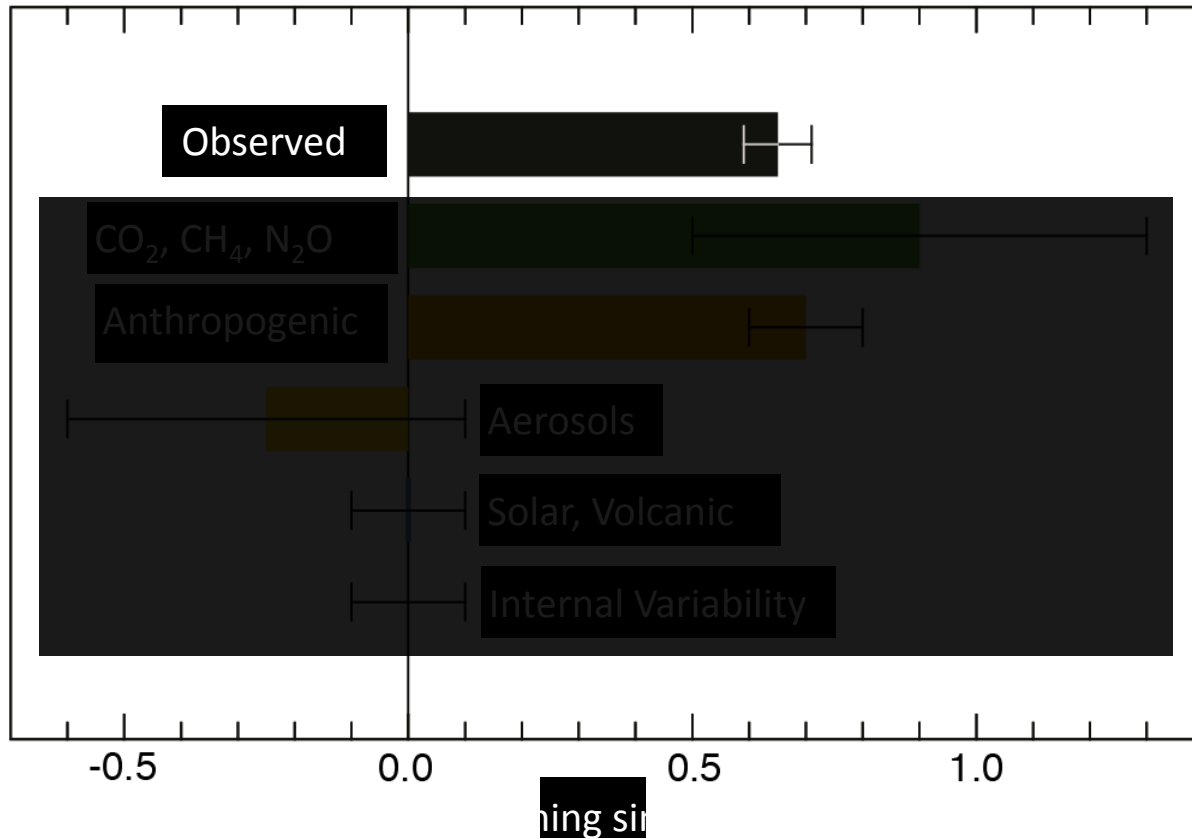


Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010 (*high confidence*).

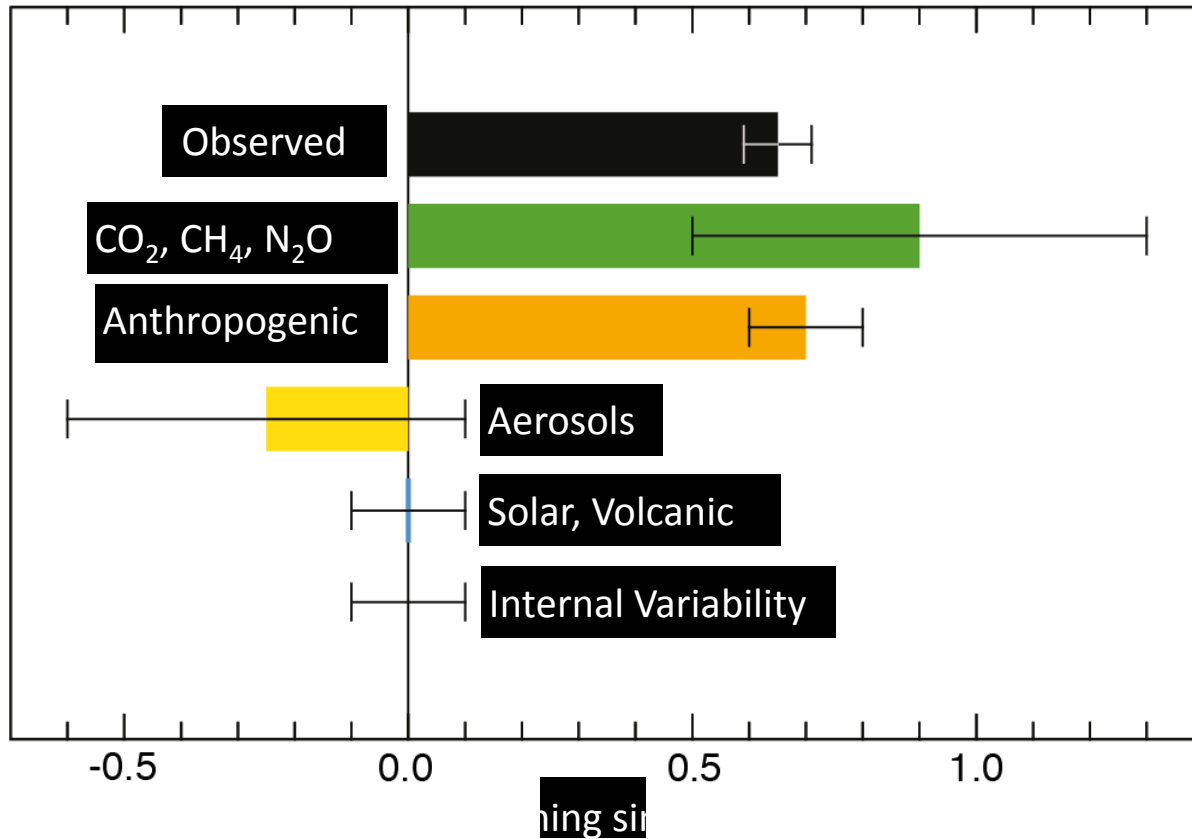




Total radiative forcing is positive, and has led to an uptake of energy in the climate system. The largest contribution [...] is caused by the increase in the atmospheric concentration of CO<sub>2</sub> since 1750.

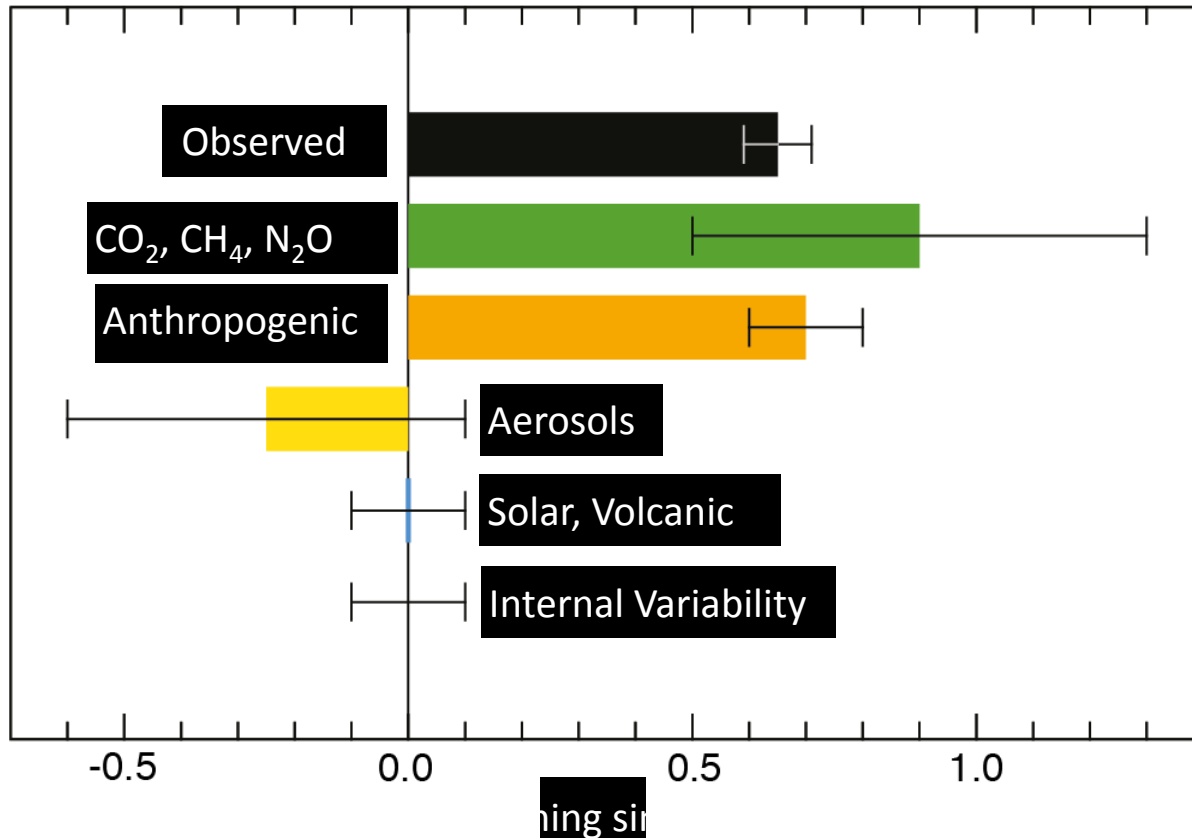


The observed warming 1951–2010 is approximately 0.6°C to 0.7°C.



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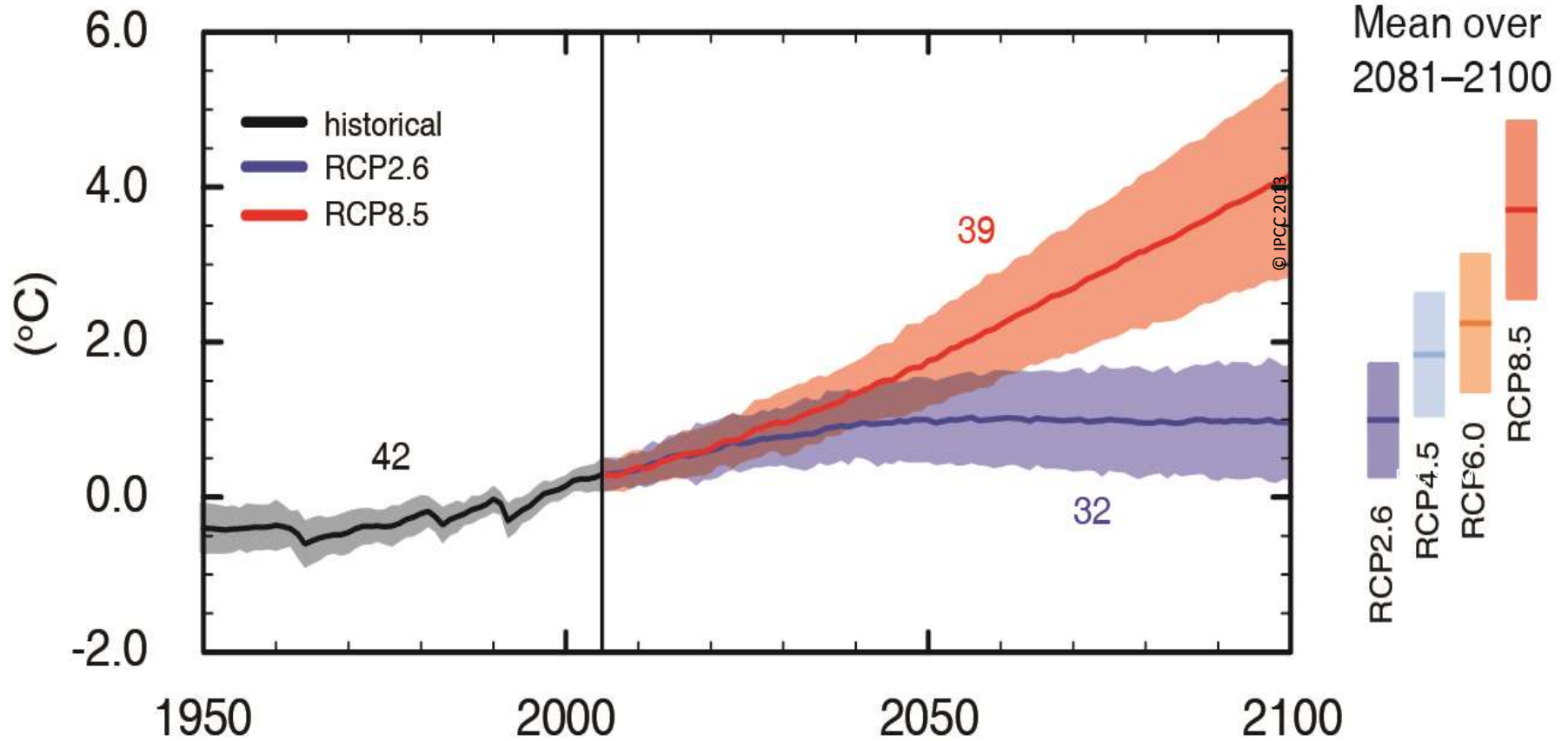
It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century.



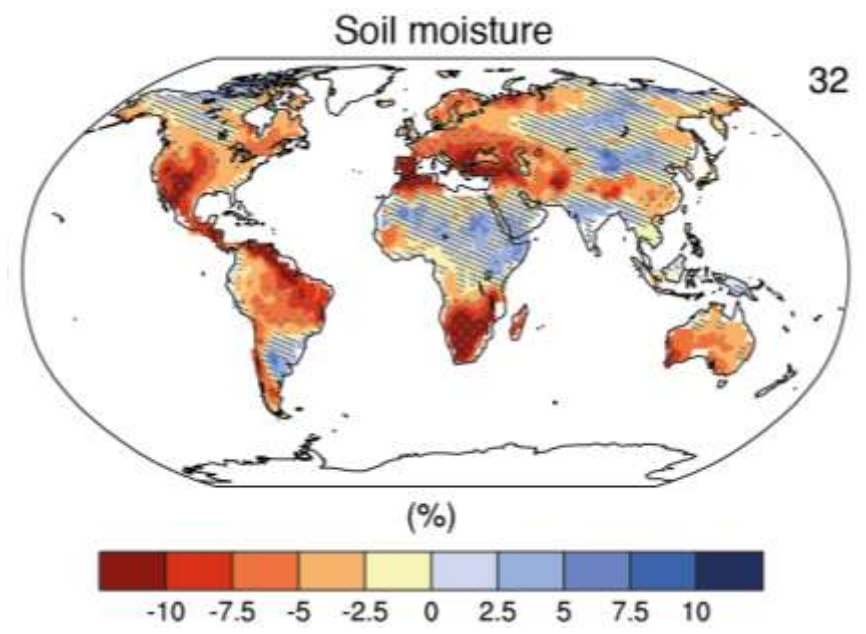
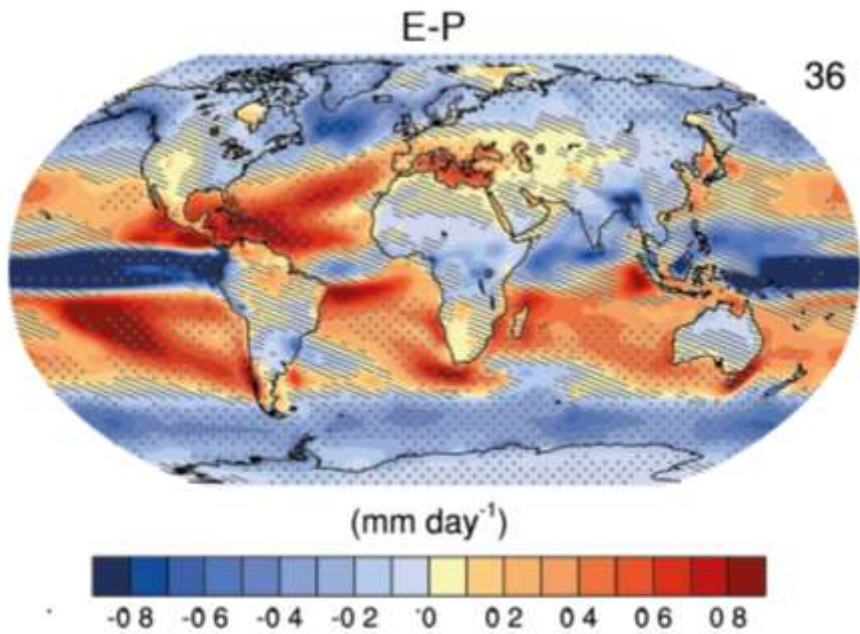
© IPCC 2013

Human influence on the climate system is clear.

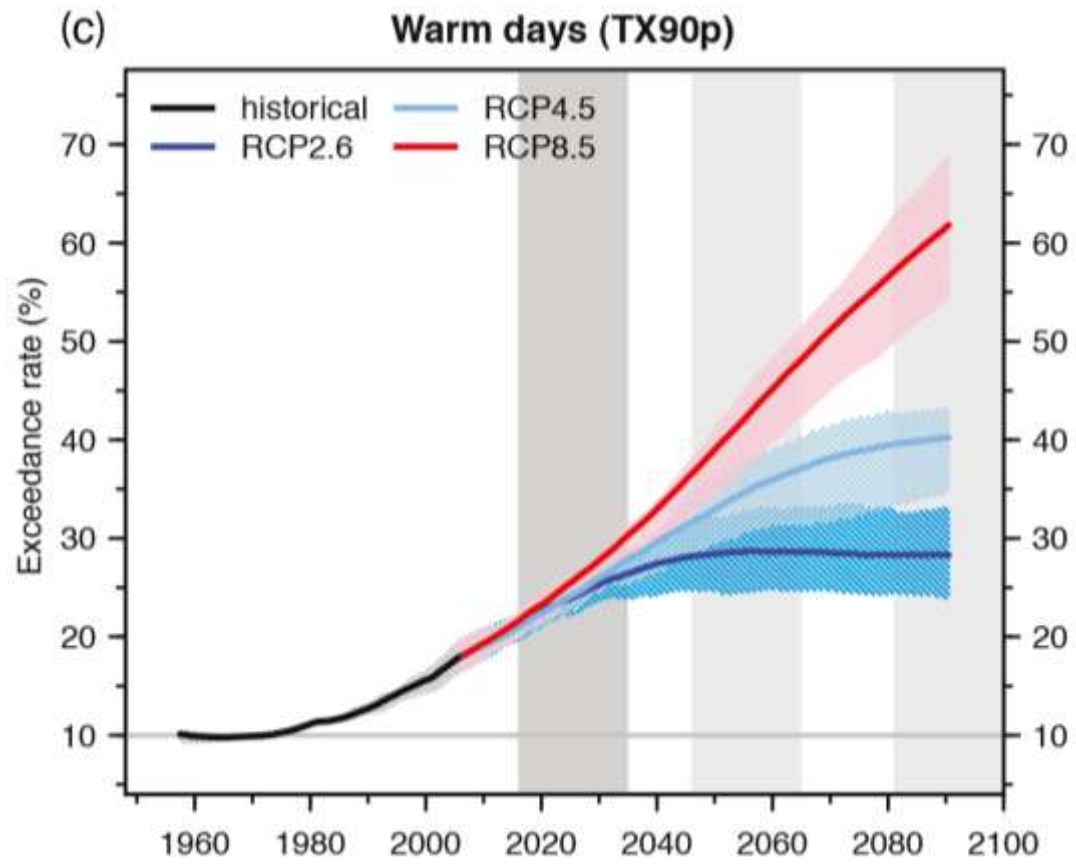
# Global average surface temperature change



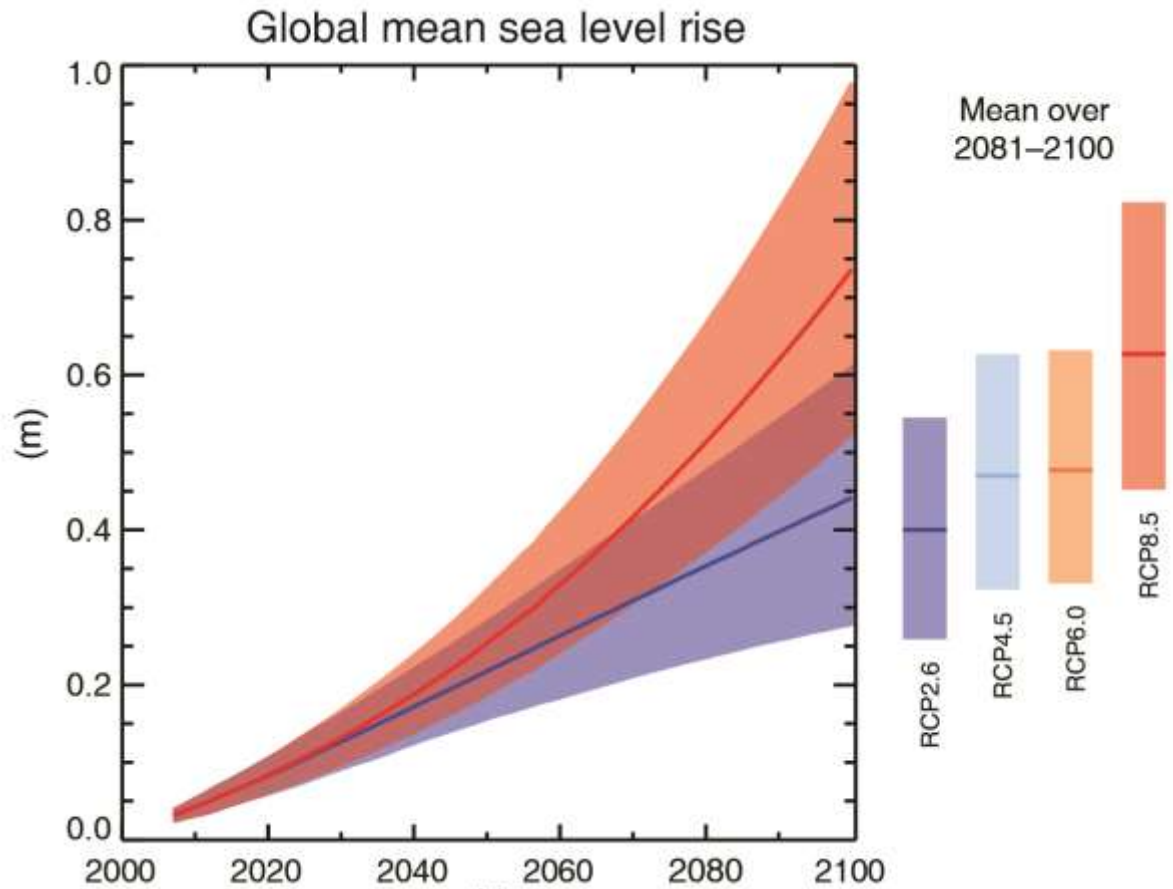
Global mean surface temperature change from 1986-2005



The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, [...]



It is *very likely* that heat waves will occur with higher frequency and duration. Occasional cold winter extremes will continue to occur.



RCP2.6 (2081-2100), *likely* range: 26 to 55 cm

RCP8.5 (in 2100), *likely* range: 52 to 98 cm



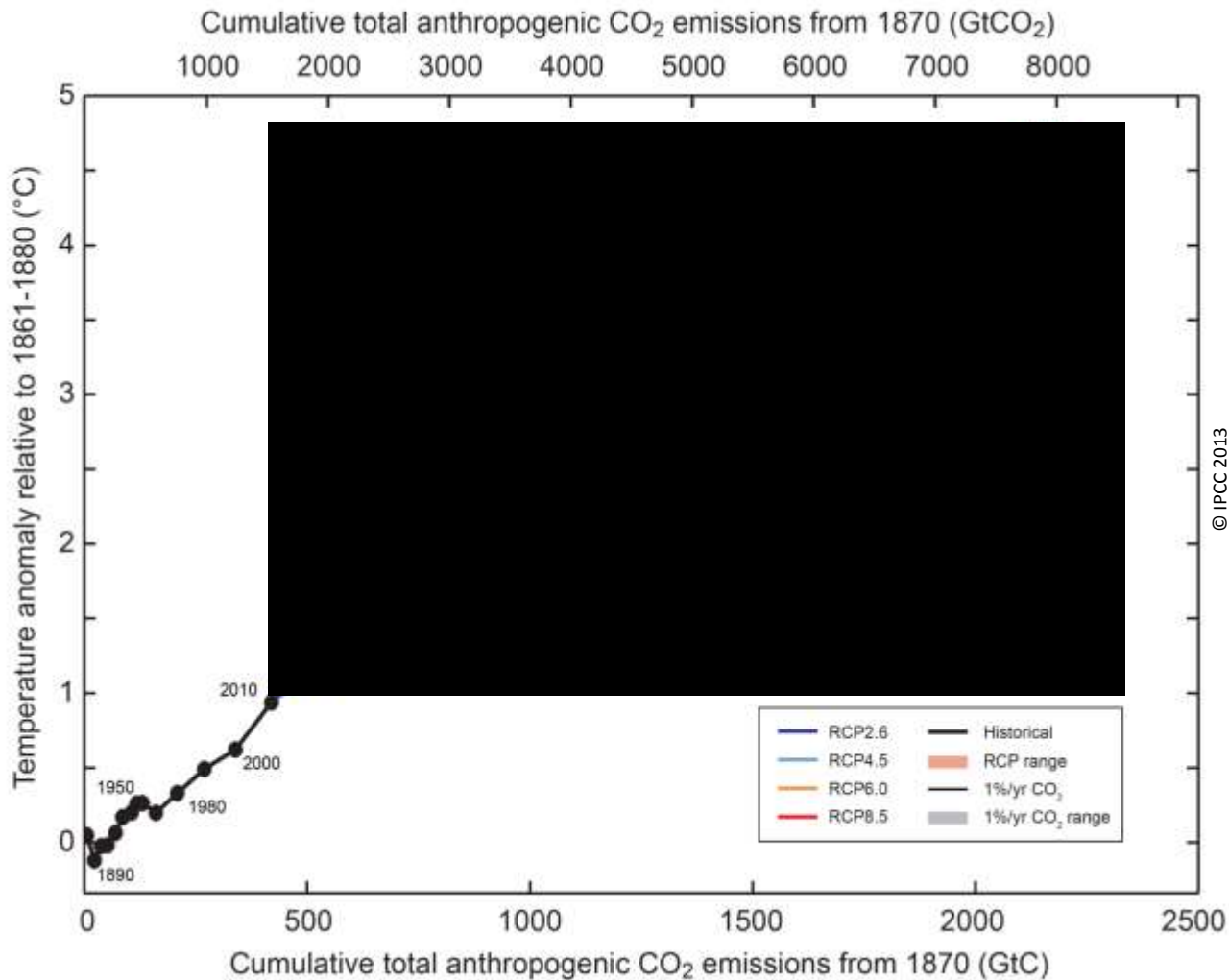


Fig. SPM.10

Cumulative emissions of CO<sub>2</sub> largely determine global mean surface warming by the late 21st century and beyond.

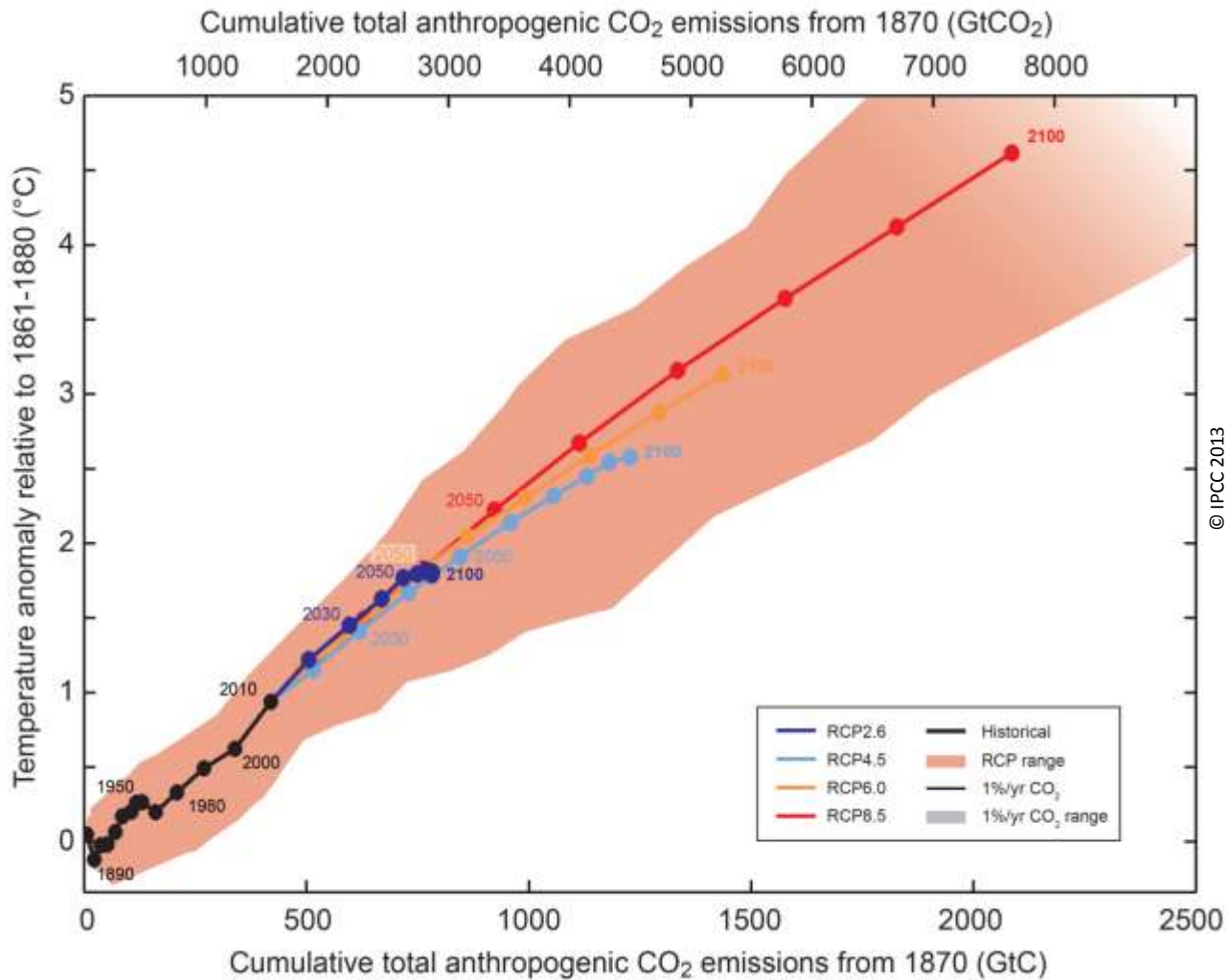
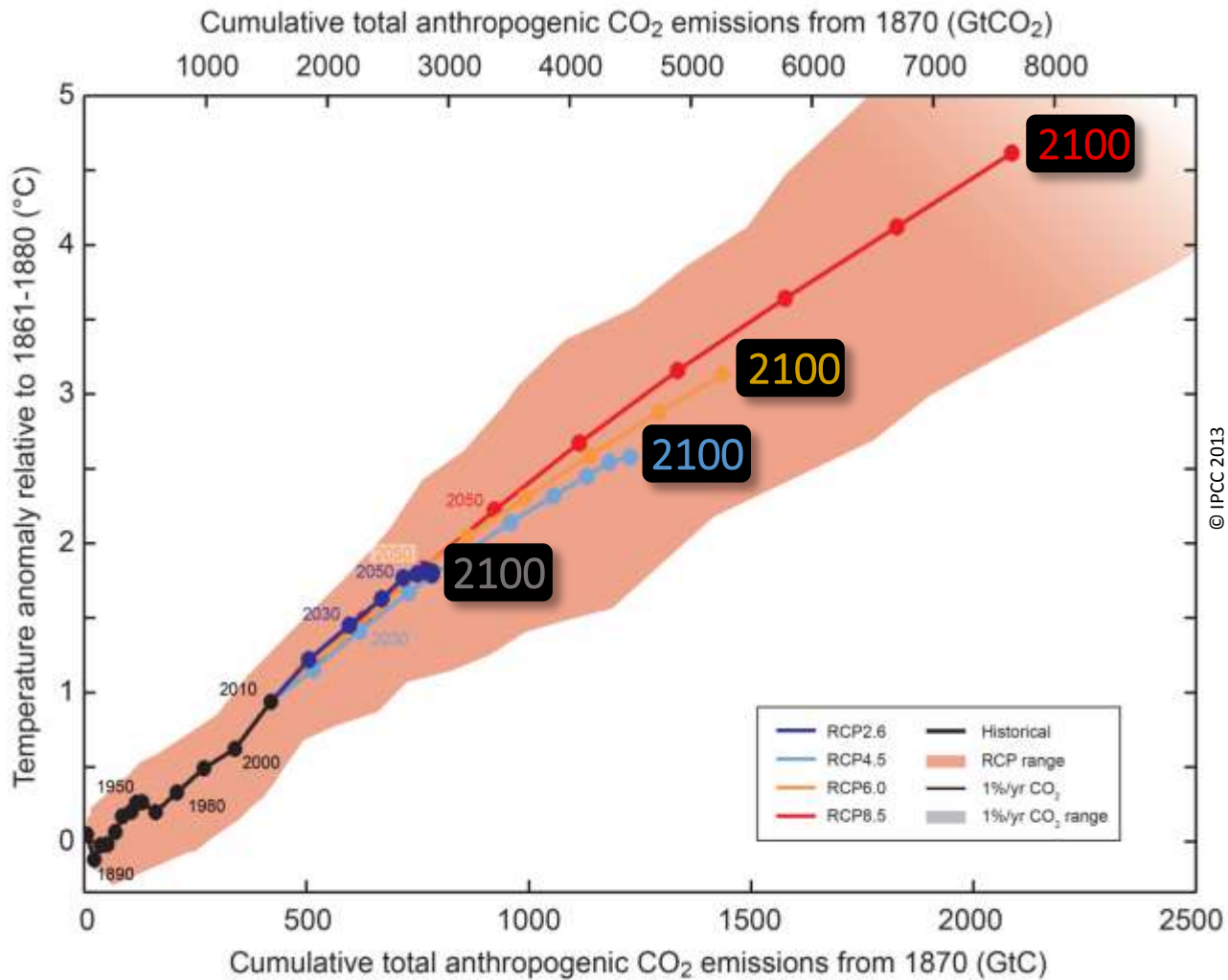


Fig. SPM.10

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.



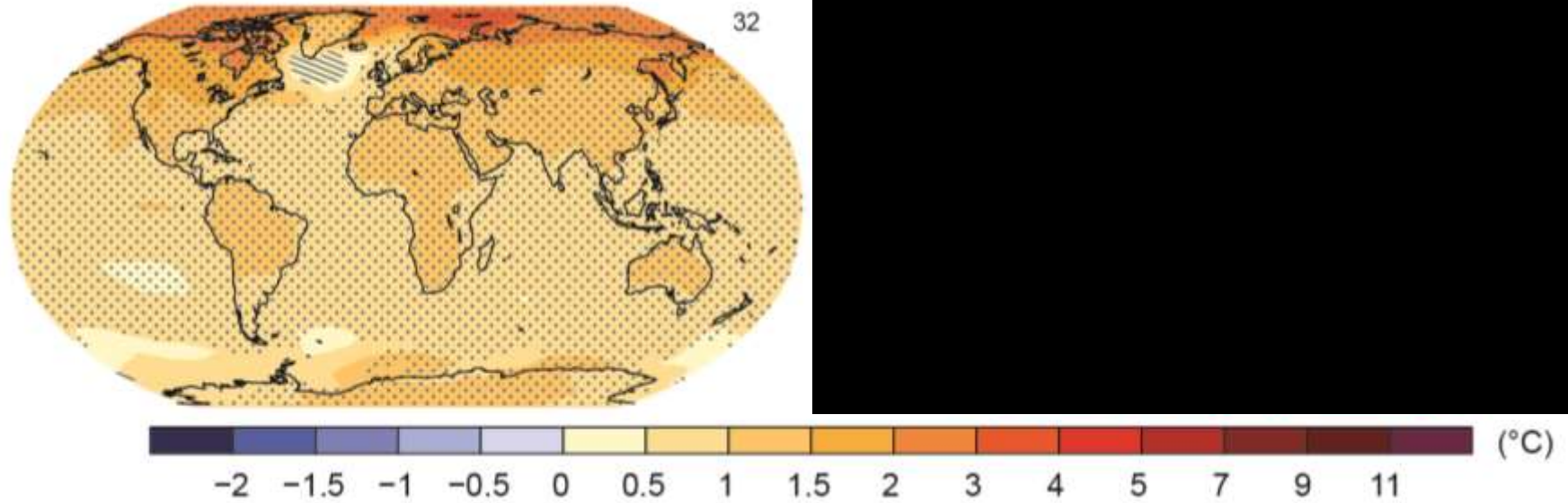
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Fig. SPM.10

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

# RCP2.6

Change in average surface temperature (1986–2005 to 2081–2100)



Choice?

Fig. SPM.8

# OVERVIEW OF WGI AR5 OUTLINE

14 CHAPTERS

**INTRODUCTION**

**CH. 1**

**OBSERVATIONS AND PALEOCLIMATE INFORMATION**

**CH. 2, 3, 4, 5**

**PROCESS UNDERSTANDING : *CARBON AND BIOGEOCHEMICAL CYCLES, CLOUDS AND AEROSOLS***

**CH. 6, 7**

**FROM FORCINGS TO ATTRIBUTION OF CLIMATE CHANGE : *FORCINGS, MODEL EVALUATION, D&A***

**CH. 8, 9, 10**

**FUTURE CLIMATE CHANGE AND PREDICTABILITY**

**CH. 11, 12**

**INTEGRATION : SEA LEVEL, CLIMATE PHENOMENA**

**CH. 13, 14**

**ATLAS OF GLOBAL AND REGIONAL PROJECTIONS**

**1523 pages**

# EXAMPLES OF GAPS IN THE WGI AR5 ASSESSMENT

## Regional aspects :

- PROJECTIONS FROM GLOBAL CLIMATE MODELS ONLY IN AR5 WGI REPORT
- REGIONAL ASPECTS IN OCEANS (E.G. UPWELLING), OCEAN EXTREME EVENTS (E.G. MARINE HEAT WAVES)
- URBAN CLIMATE KNOWLEDGE, INCLUDING AIR QUALITY

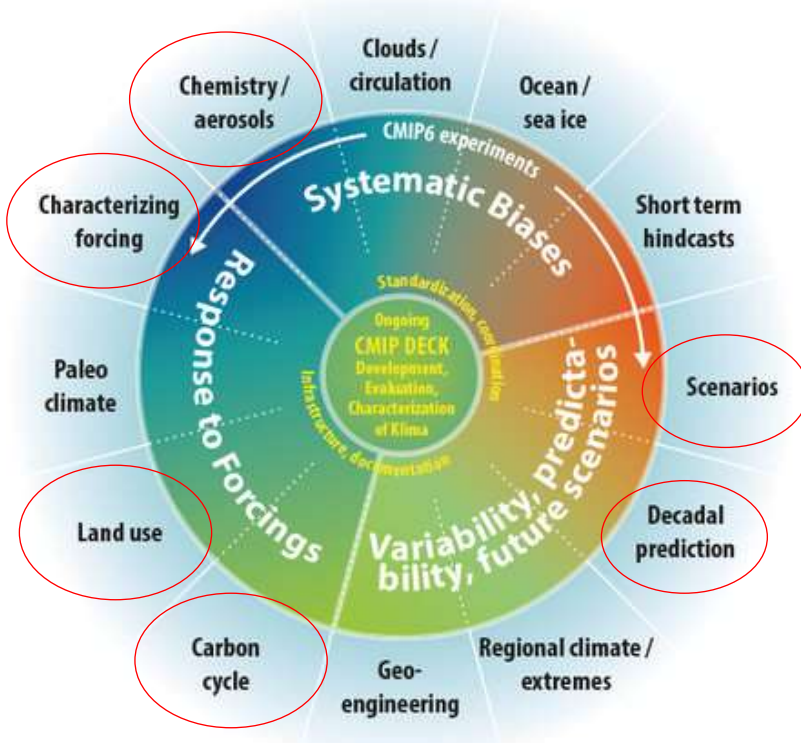
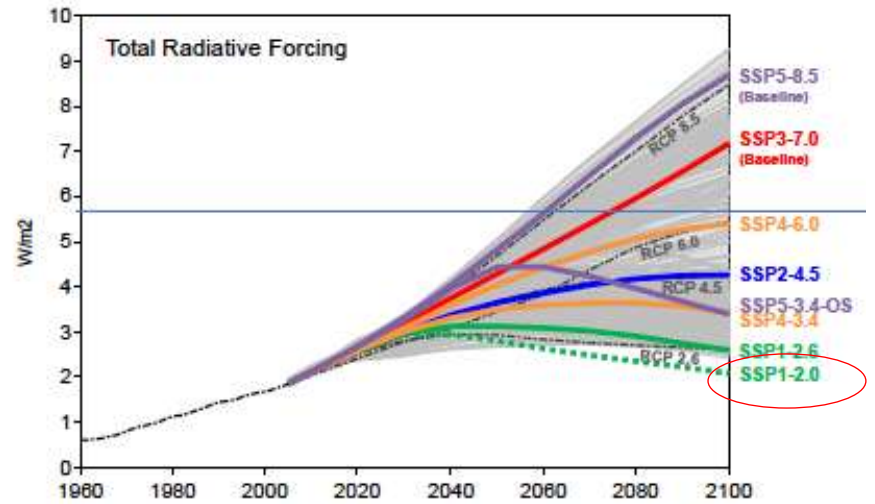
Linkage to impacts, adaptation and mitigation

# Projections, global emission pathway and long-term goals

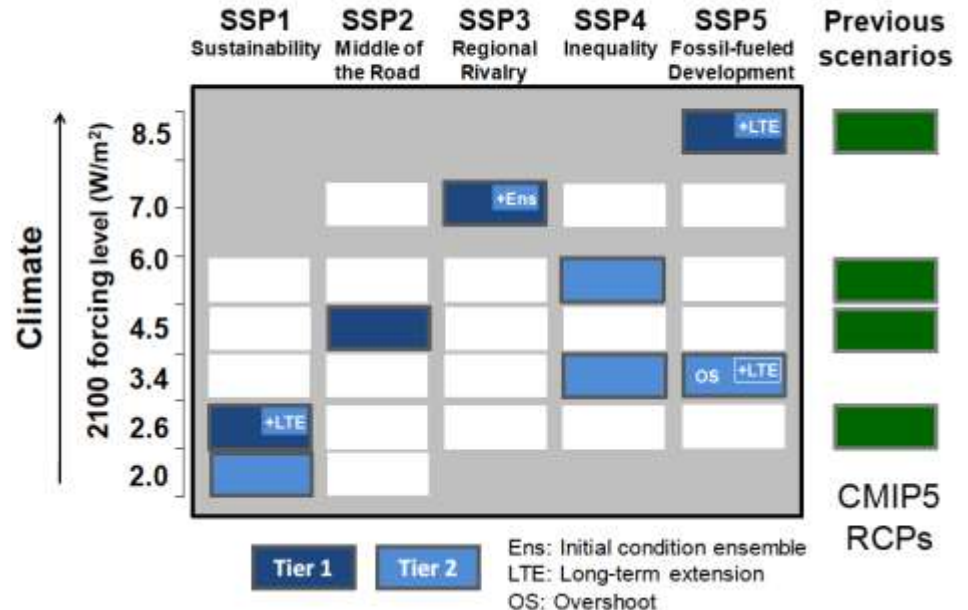
ScenarioMIP for CMIP6, O'Neil et al, GMD Discussion 2016

New shared socio-economic pathways

CMIP6



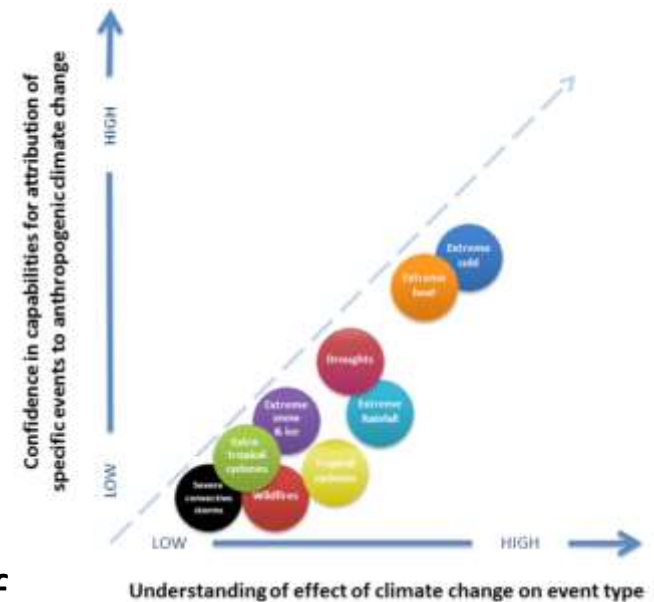
## Shared Socioeconomic Pathways



# Attribution of anthropogenic climate change on recent drought

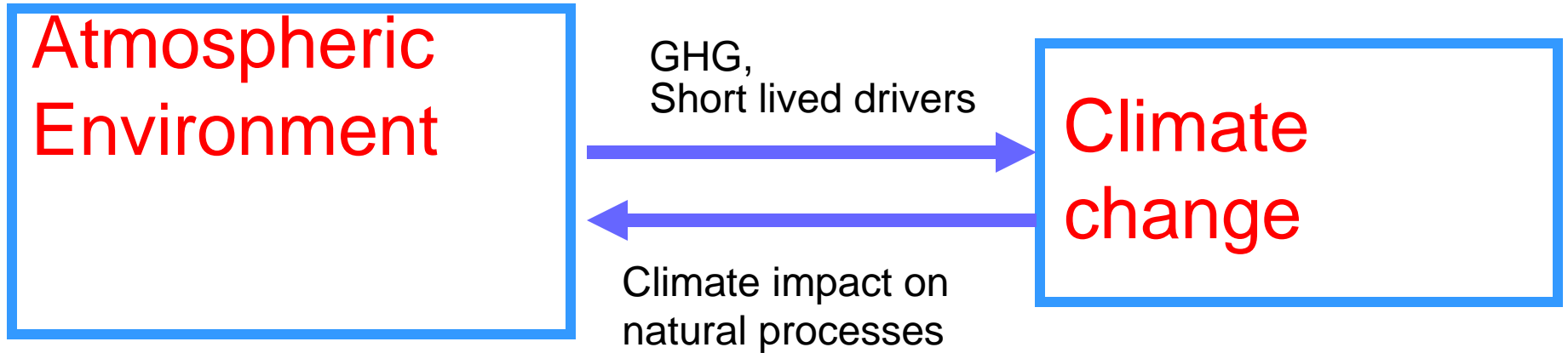
- ❖ **California:** rainfall deficit linked to natural variability, water stress enhanced by warming trend (Griffin et al, GRL, 2014; Williams et al, GRL 2015; Diffenbaugh et al, PNAS, 2015; Cheng et al., 2016, J Clim)
- ❖ **Levant region :** drought twice more likely due to human influence on drying and warming trend (Bergaoui et al., 2015, BAMS; Cook et al, JGR, 2016, Kelley et al, PNAS, 2015),
- ❖ **Australia :** human influence on large scale drivers (Cai et al., 2014, J. Clim)
- ❖ **Sahel rainfall recovery since the 1980s :** role of greenhouse-gas and aerosol forcing (Dong and Sutton, Nature Climate Change, 2015)

*NAS Report, Attribution of extreme weather events, 2016*





# Climate change and air quality



# CROSS-CUTTING ISSUES

**X WGII : REGIONAL CLIMATE CHANGE AND IMPACTS**

**X WGIII : SCENARIOS AND PATHWAYS**

**X ALL WORKING GROUPS**

- **AIR QUALITY AND SHORT LIVED CLIMATE POLLUTANTS**
- **WATER AND CARBON IN A CHANGING CLIMATE**
- **SOLAR RADIATION MANAGEMENT AND GHG REMOVAL**
- **RISK ASSESSMENT**

# AR6 WGI Outline

Ch1: Framing, context, methods

Ch2: Changing state of the climate system

Ch3: Human influence on the climate system

Ch4: Future global climate: scenario-based projections and near-term information

Large scale changes

Ch5: Global carbon, biogeochemical cycles and feedbacks

Ch6: Short-lived climate forcers

Ch7: The Earth's energy budget, climate feedbacks, and climate sensitivity

Ch8: Water cycle changes

Ch9: Ocean, cryosphere, and sea level change

Processes

Ch10: Linking global to regional climate change

Ch11: Weather and climate extreme events in a changing climate

Ch12: Climate change information for regional impact and risk assessment

+ Regional Atlas

Regional Focus

# AR6 WGI Outline

Ch1: Framing, context, methods

Ch2: Changing state of the climate system

Ch3: Human influence on the climate system

[Link to WGIII](#)

Ch4: Future global climate: scenario-based projections and near-term information

Ch5: Global carbon, biogeochemical cycles and feedbacks

Ch6: Short-lived climate forcers

Ch7: The Earth's energy budget, climate feedbacks, and climate sensitivity

Ch8: Water cycle changes

[Link to WGII](#)

Ch9: Ocean, cryosphere, and sea level change

Ch10: Linking global to regional climate change

Ch11: Weather and climate extreme events in a changing climate

Ch12: Climate change information for regional impact and risk assessment

+ Regional Atlas

Many Thanks!