



Climate Change: The Physical Science Basis

Panmao Zhai,
Co-Chair IPCC WGI

What has Changed?

Why has it changed ?

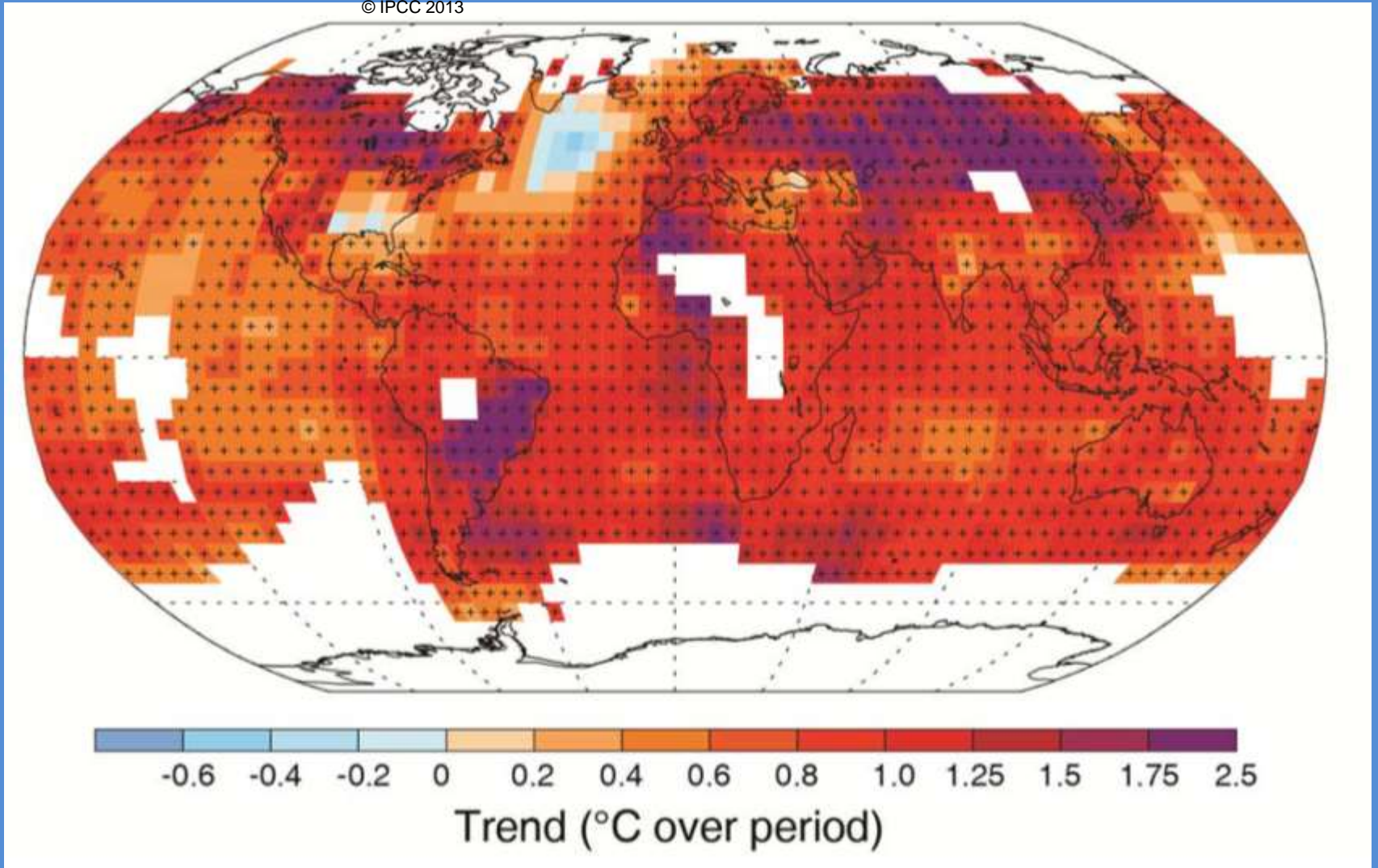
How will it change?

What has changed?

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

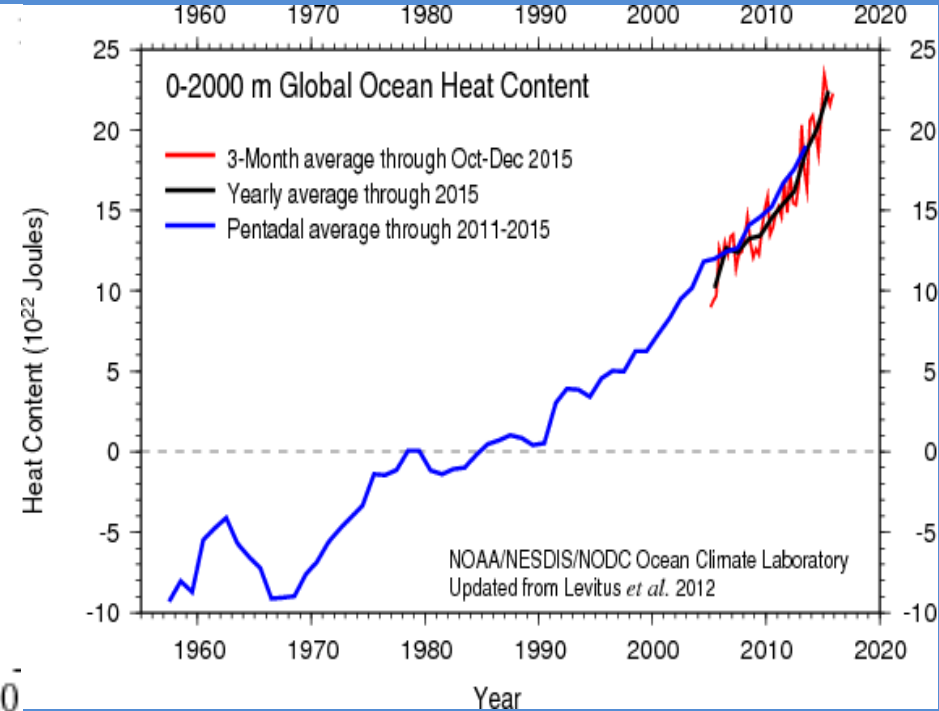
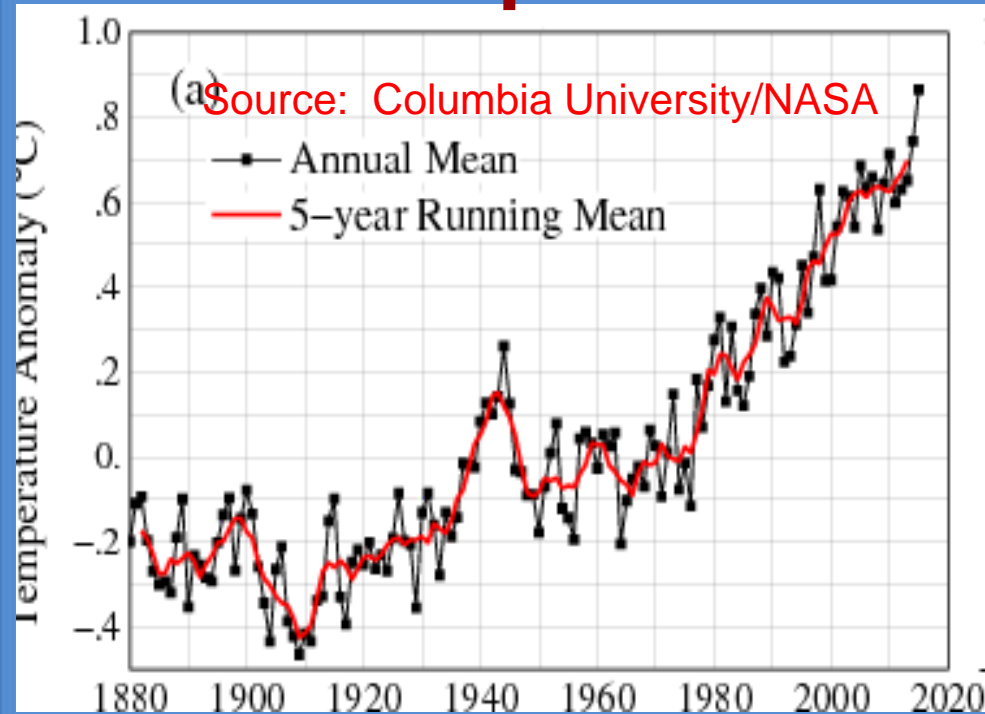
© IPCC 2013

Fig. SPM.1b



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

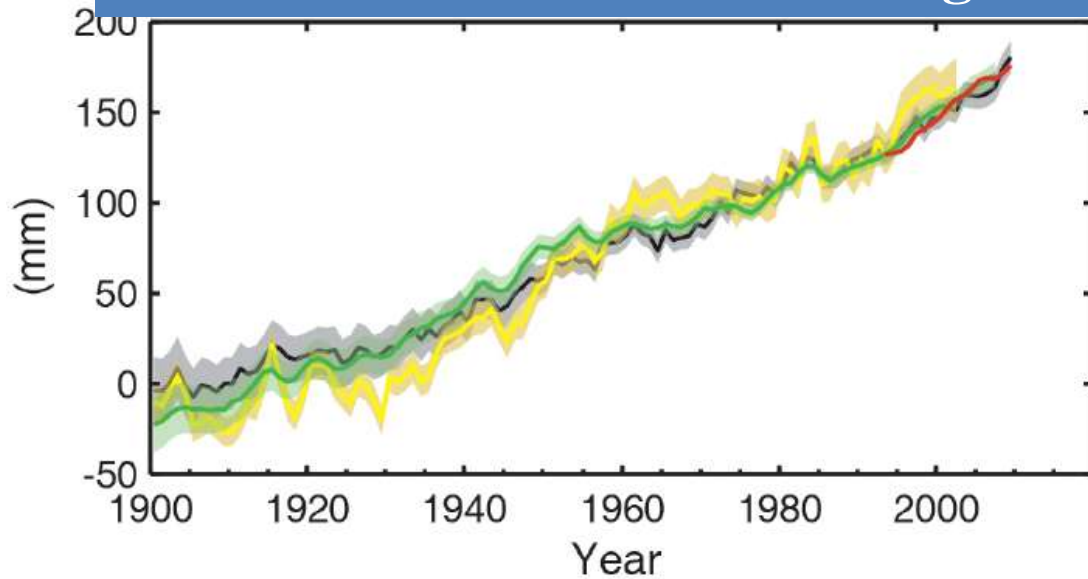
Updated Monitoring on changes in global mean temperature and ocean heat content



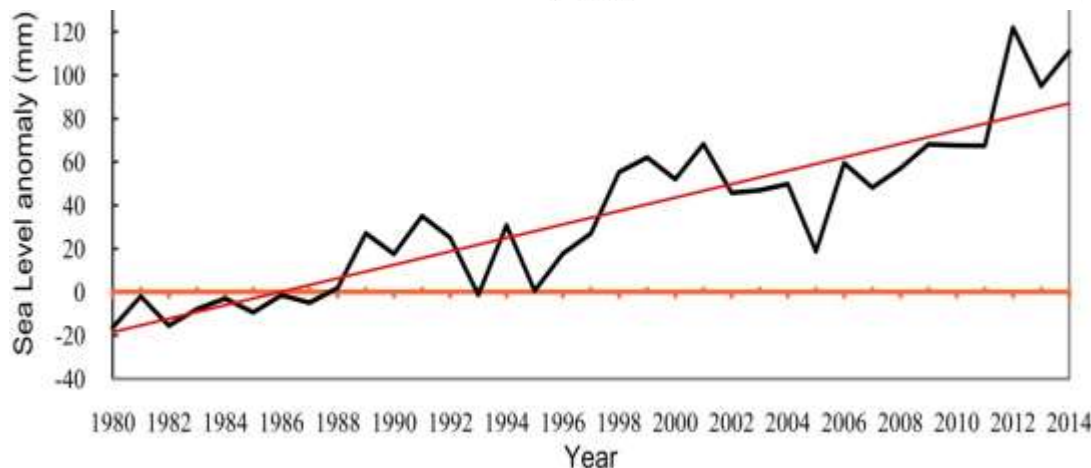
- ❖ Recent observations confirm the warming trend continues!
- ❖ 2015 is **1.0°C** above pre-industrial level! **Only 0.5C space?**
- ❖ More than 90% of the energy stored in the ocean!



Contribution of Climate Change to Sea Level Rise in China



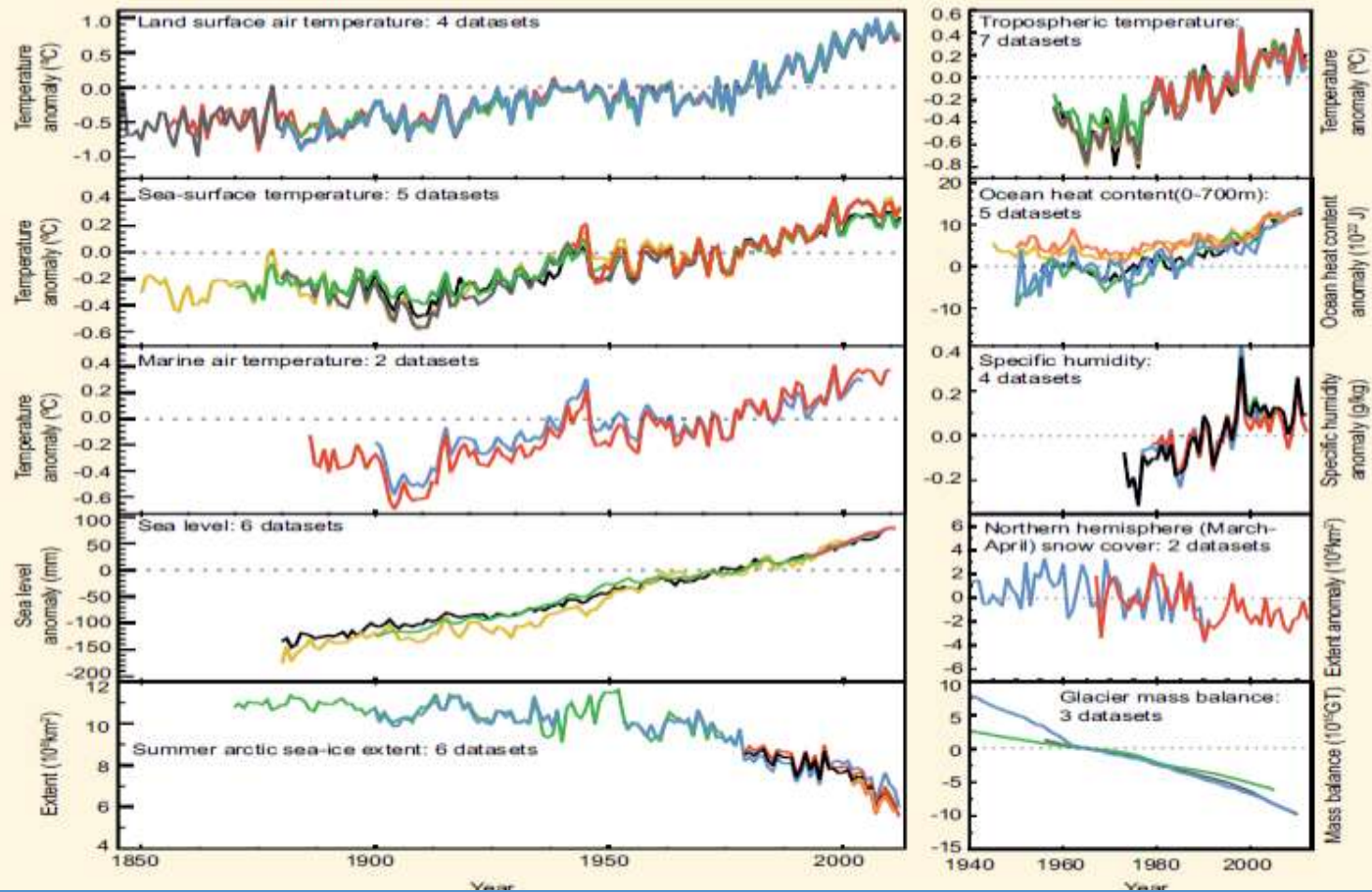
Over the period 1901 to 2010, global mean sea level rose by 0.19 m.



China Coastal Averaged Sea-Level Change

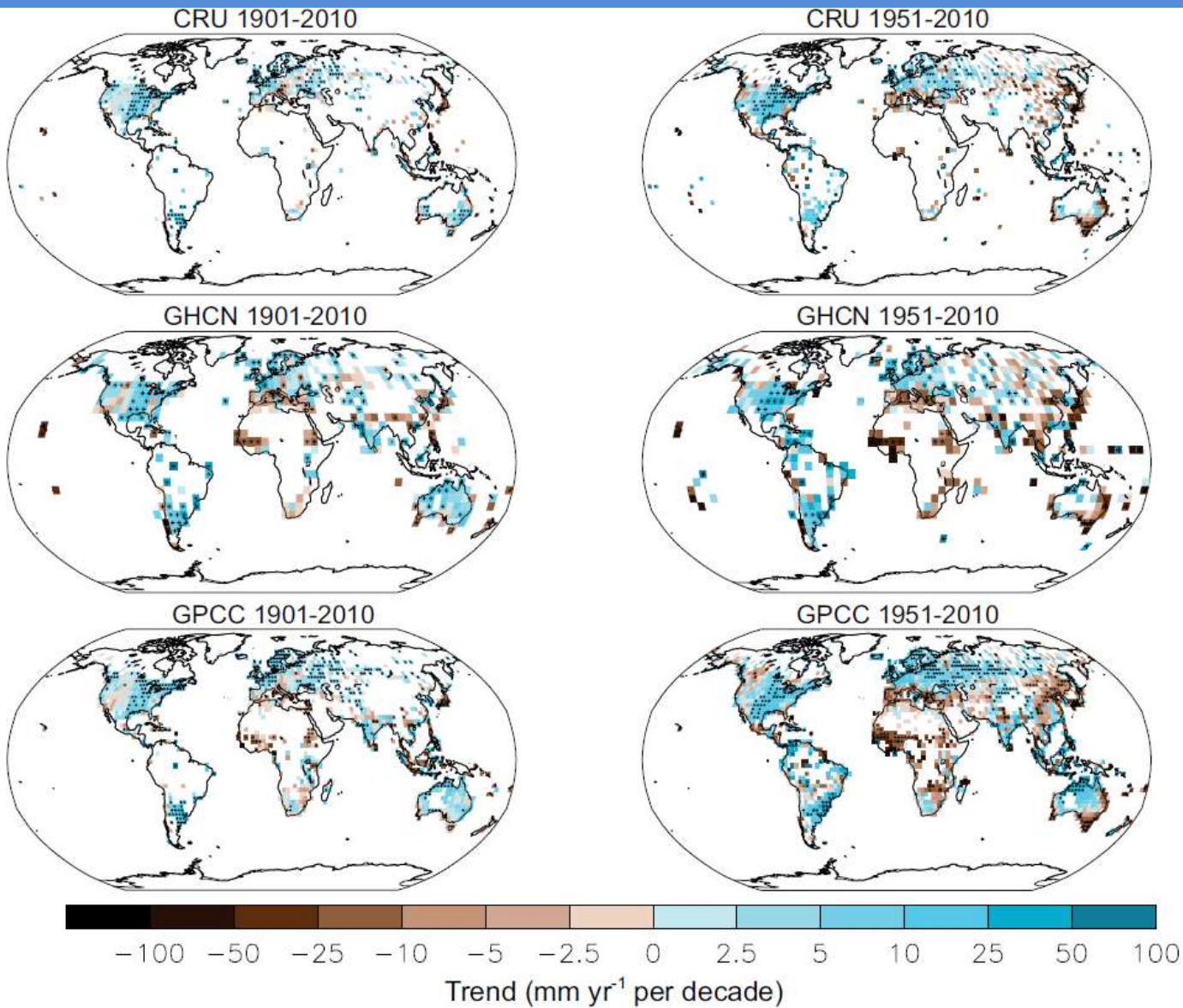
Mean sea level rise rate in China coastal is 3.0mm yr⁻¹ between 1981 and 2014, higher than the global average (1.7mm/y).

The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (high confidence).



Multiple Lines of Evidence for Climate Change :

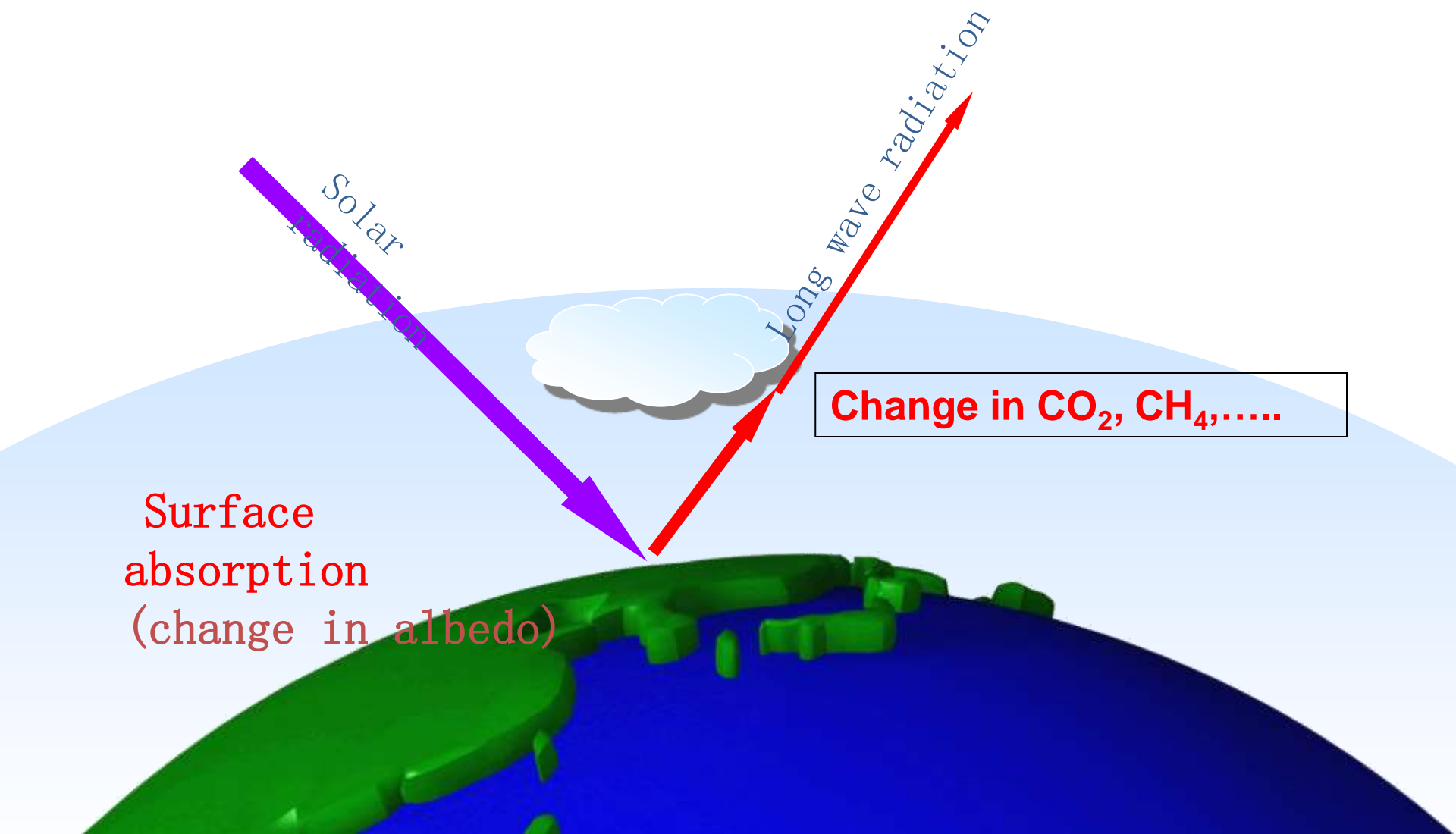
- *Warming atmosphere & ocean, snow and ice melting, and sea level rising ,, all reflect consistent warming trend.*



- Regional differences are obvious in **precipitation changes**, but long term observations are incomplete in many regions, especially at **centeninal time scale!**

Why has it changed?

Warming of the earth surface depends on radiation budget of the Climate System.



Surface
absorption
(change in albedo)

Change in CO₂, CH₄,.....

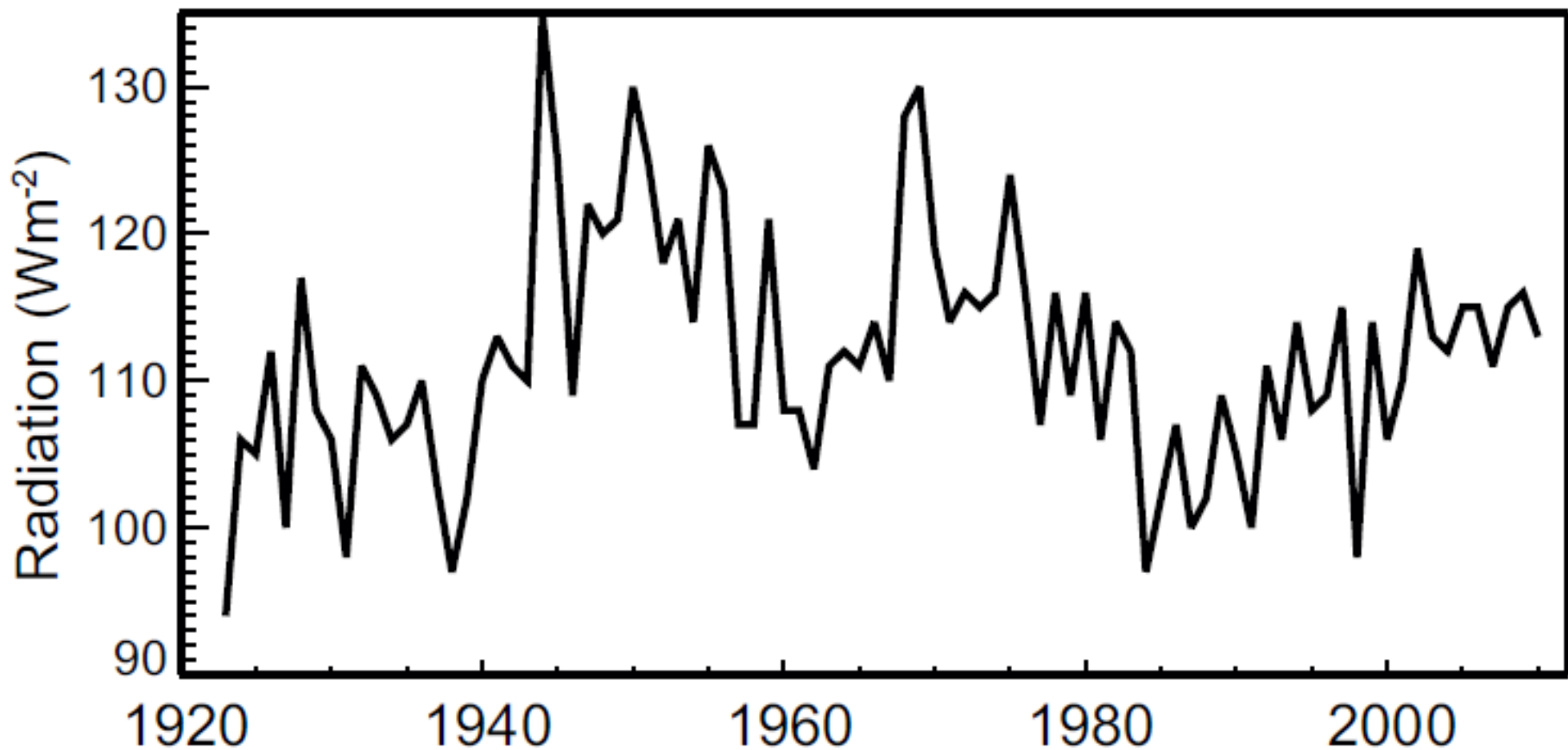
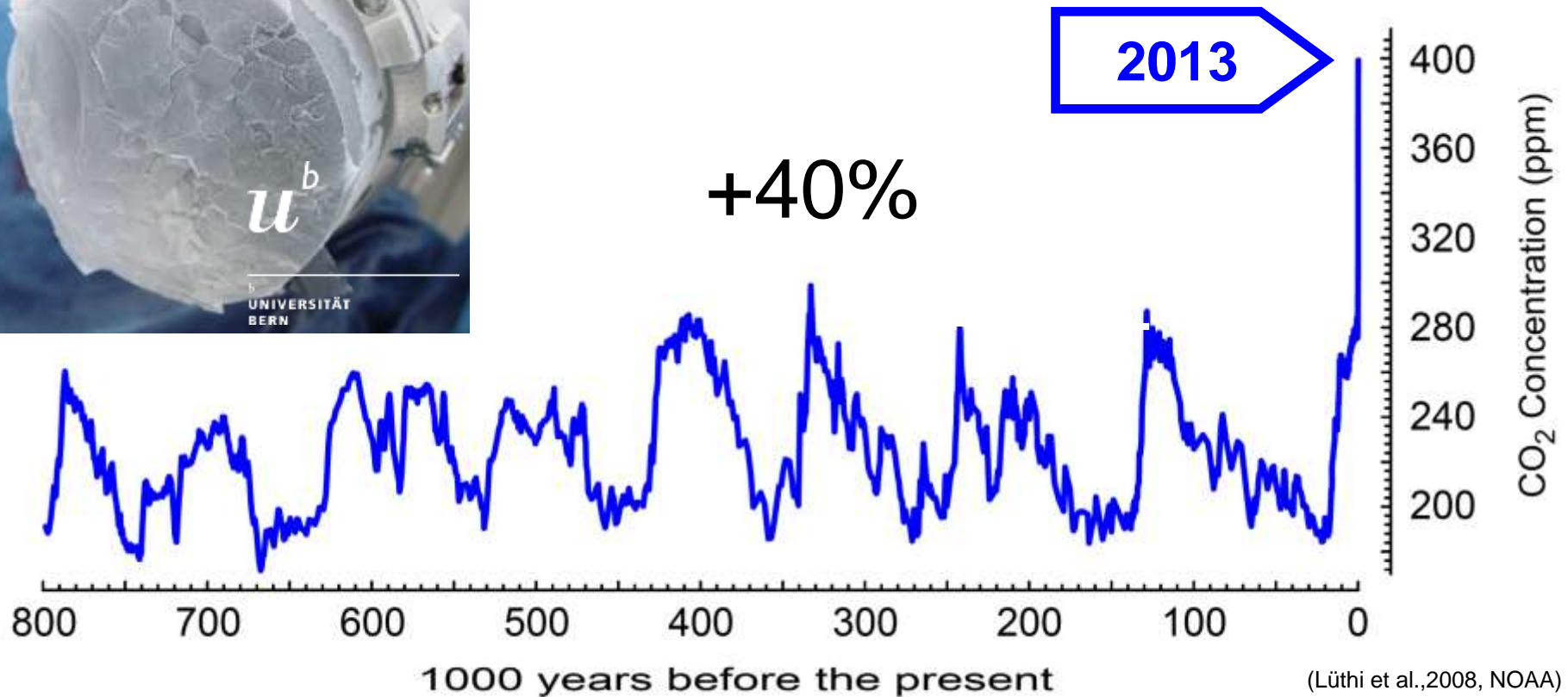
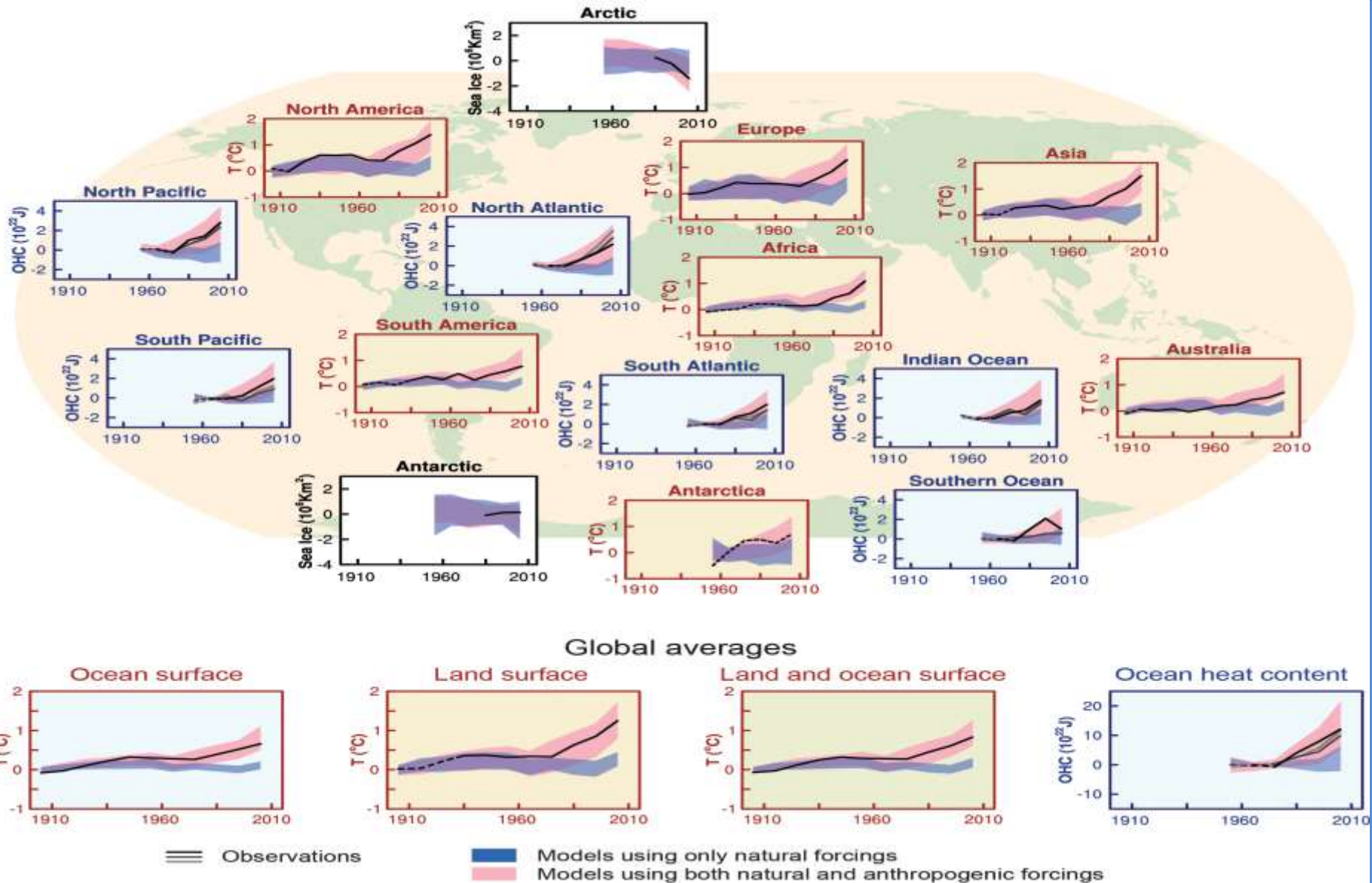


Figure 2.13 | Annual mean Surface Solar Radiation (SSR) as observed at Stockholm, Sweden, from 1923 to 2010. Stockholm has the longest SSR record available world-

No long term trend has been observed in surface solar radiation.



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

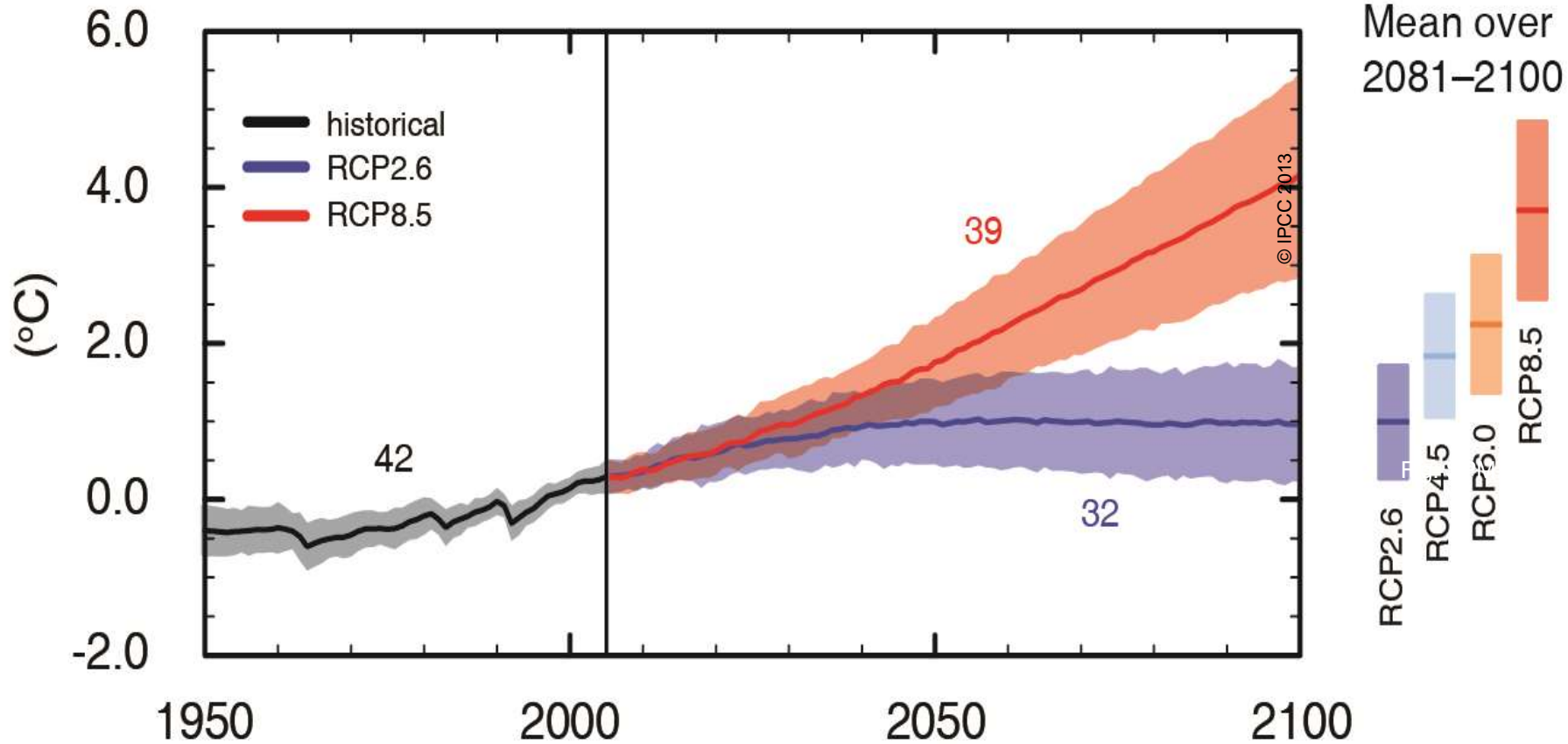


Human influence on the climate system is clear. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.

How will it Change?

Global mean surface temperature change from 1986-2005

Global average surface temperature change

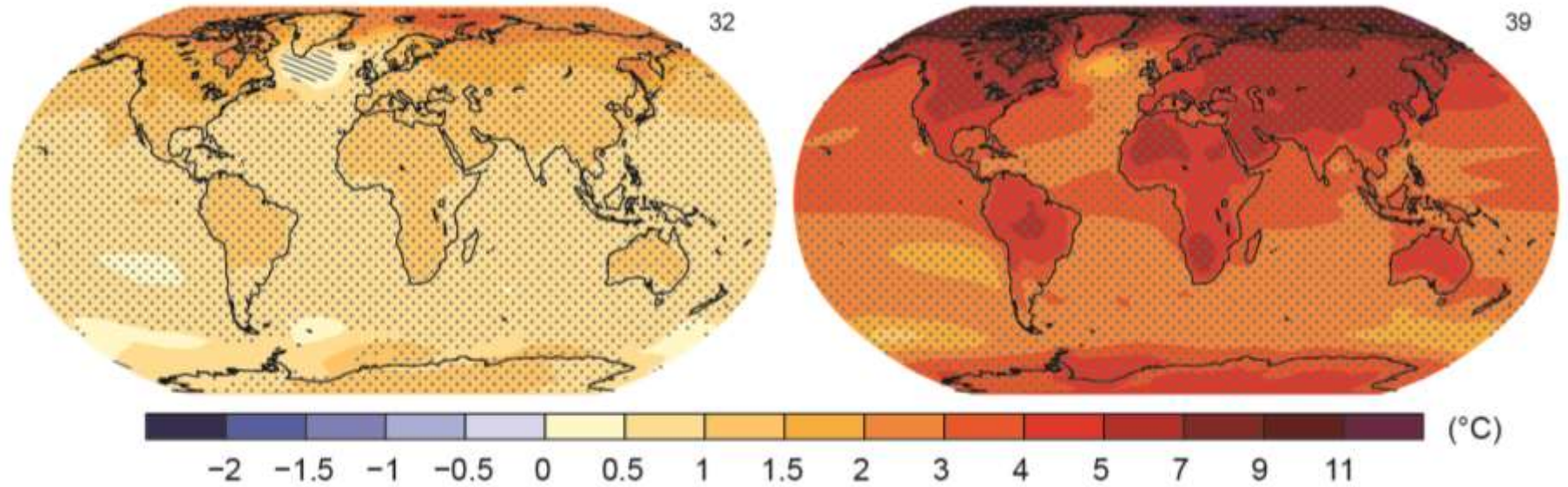


GMST change for the end of the 21st century is likely to exceed 1.5°C relative to 1850-1900 for all RCPs except under mitigation scenario with very low forcing level (RCP2.6).

RCP2.6

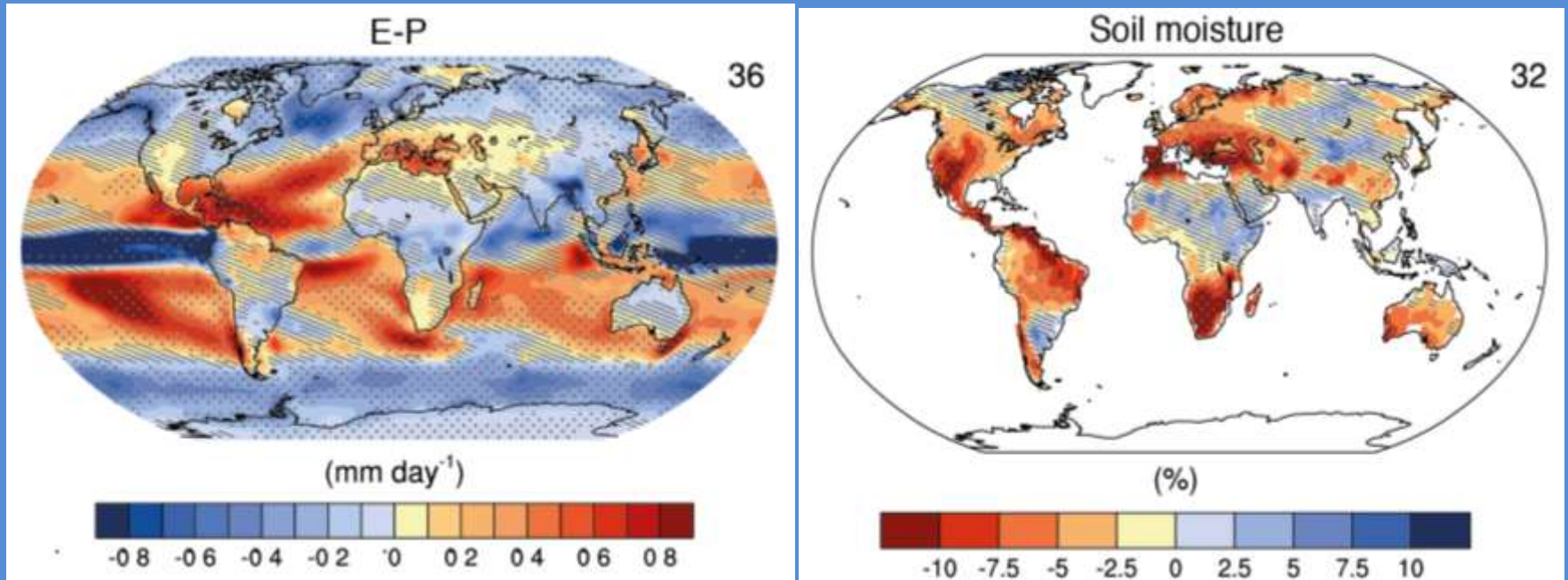
RCP8.5

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

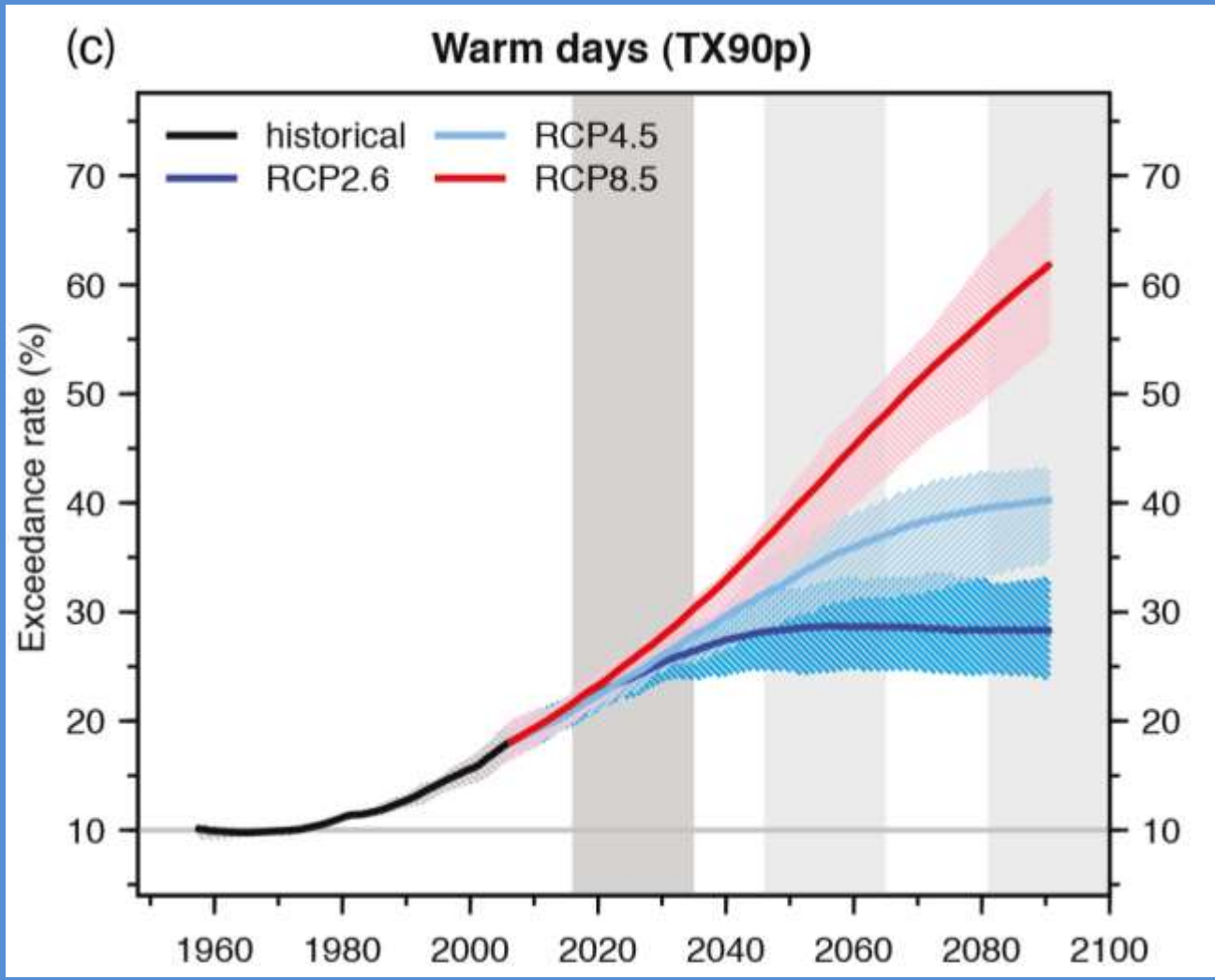


Warming will not be regionally uniform!

Change in water cycle properties from 1986-2005 to 2081-2100 in RCP8.5



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.

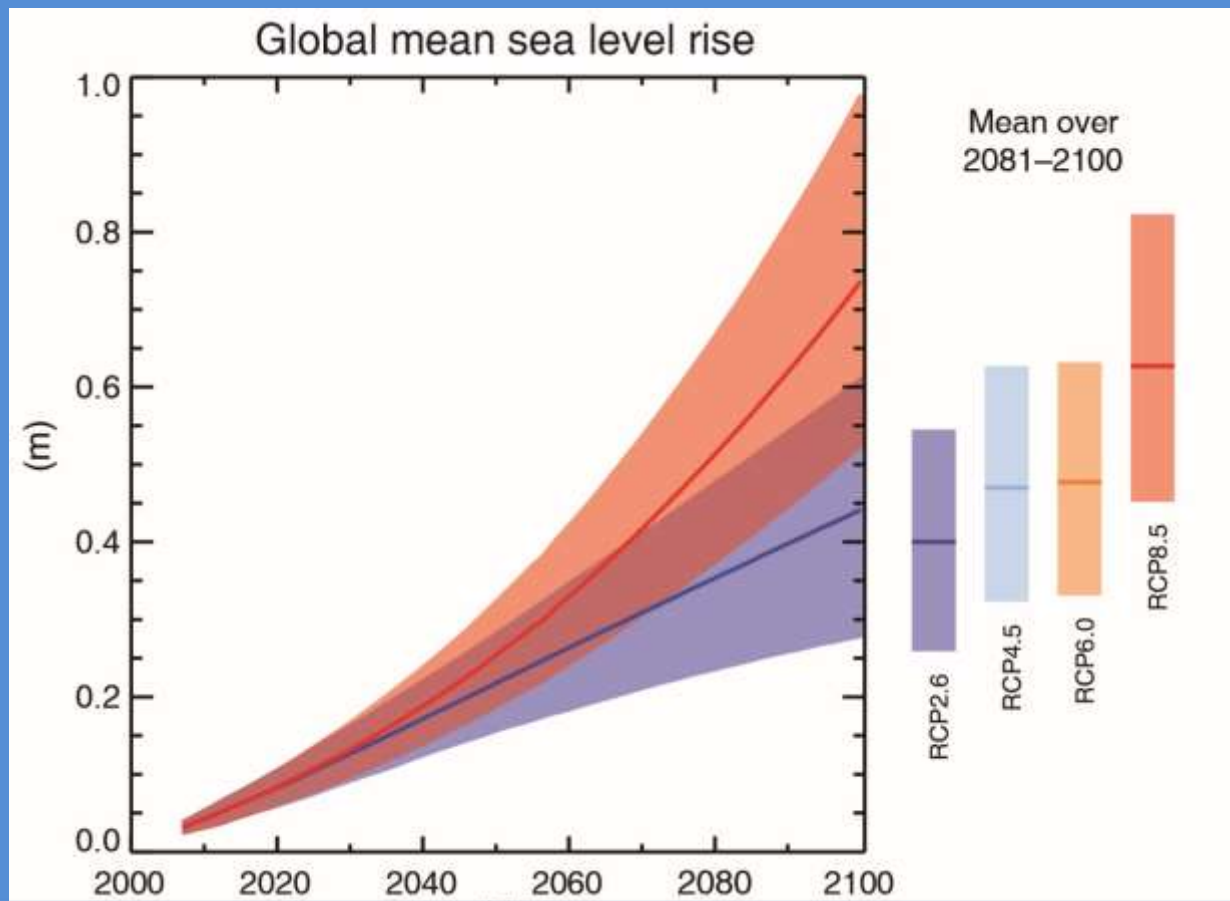


Fig. SPM.9

RCP2.6 (2081-2100), *likely* range: 26 to 55 cm
RCP8.5 (in 2100), *likely* range: 52 to 98 cm

Global mean sea level will continue to rise during the 21st, due to increased ocean warming and increased loss of mass from glaciers and ice sheets.

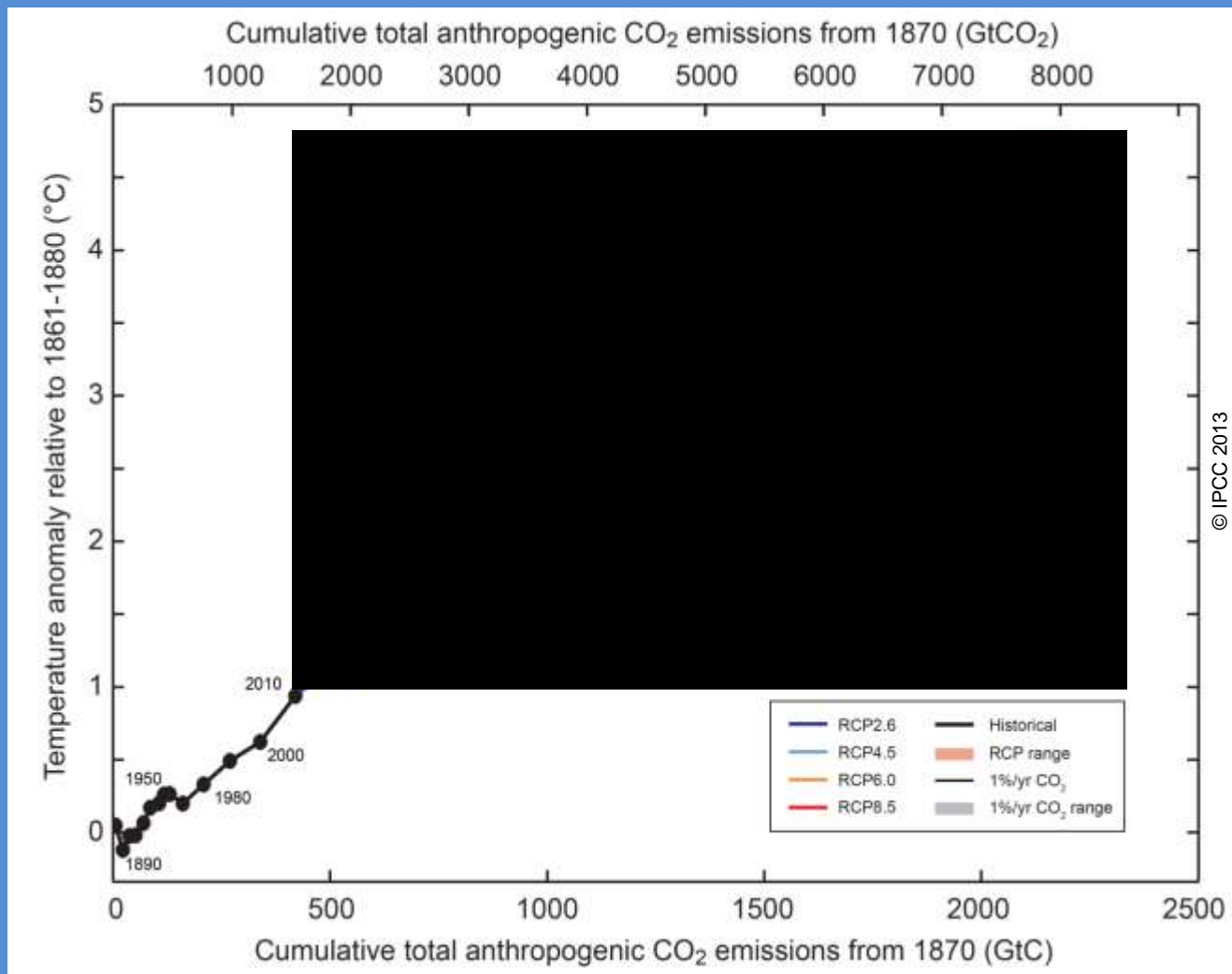


Fig. SPM.10

Cumulative emissions of CO₂ largely determine global mean surface warming by the late 21st century and beyond.

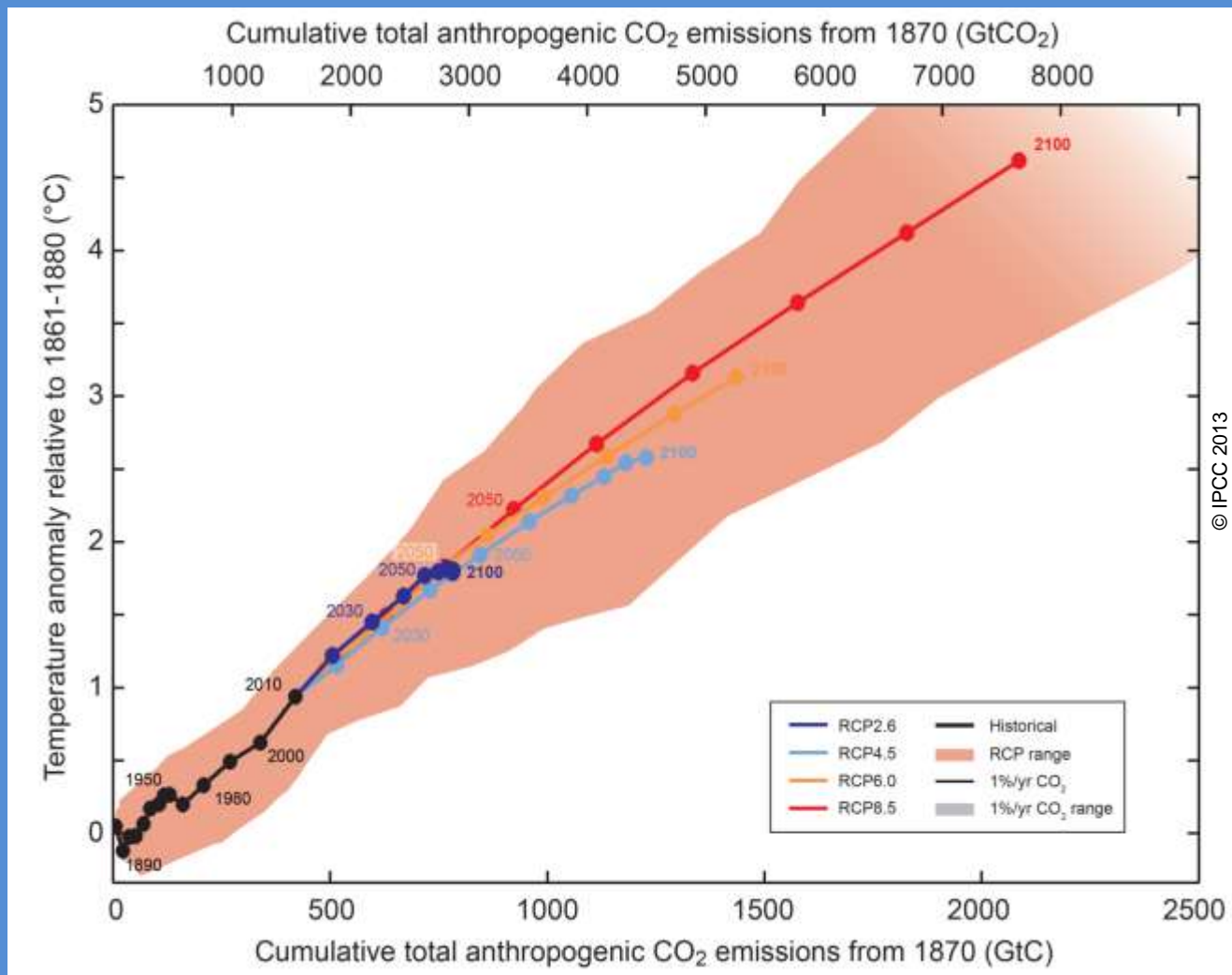


Fig. SPM.10

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

Topics of likely interest for AR6

1. Uncertainties in changes in circulation, cloudiness and water cycle etc. will be reduced;
2. Confidences in large scale change in drought, cyclones, and small scale extremes are expected to increase;
3. Understanding about process, feedback and sensitivity and science will be improved.
4. Regionality will be further stressed!
5. Linkage to impacts, adaptation and mitigation will be strengthened!

.....

THANK YOU FOR YOUR ATTENTION!

For more information:

Website: <http://ipcc.ch/>

IPCC Secretariat: ipcc-sec@wmo.int

IPCC Press Office: ipcc-media@wmo.int

Find us on:



@IPCCNews



IPCC_Climate_Change



<http://www.slideshare.net/ipcc-media/presentations>



<https://www.youtube.com/c/ipccgeneva>



@IPCC_CH



<https://www.linkedin.com/company/ipcc>



<https://www.flickr.com/photos/ipccphoto/sets/>



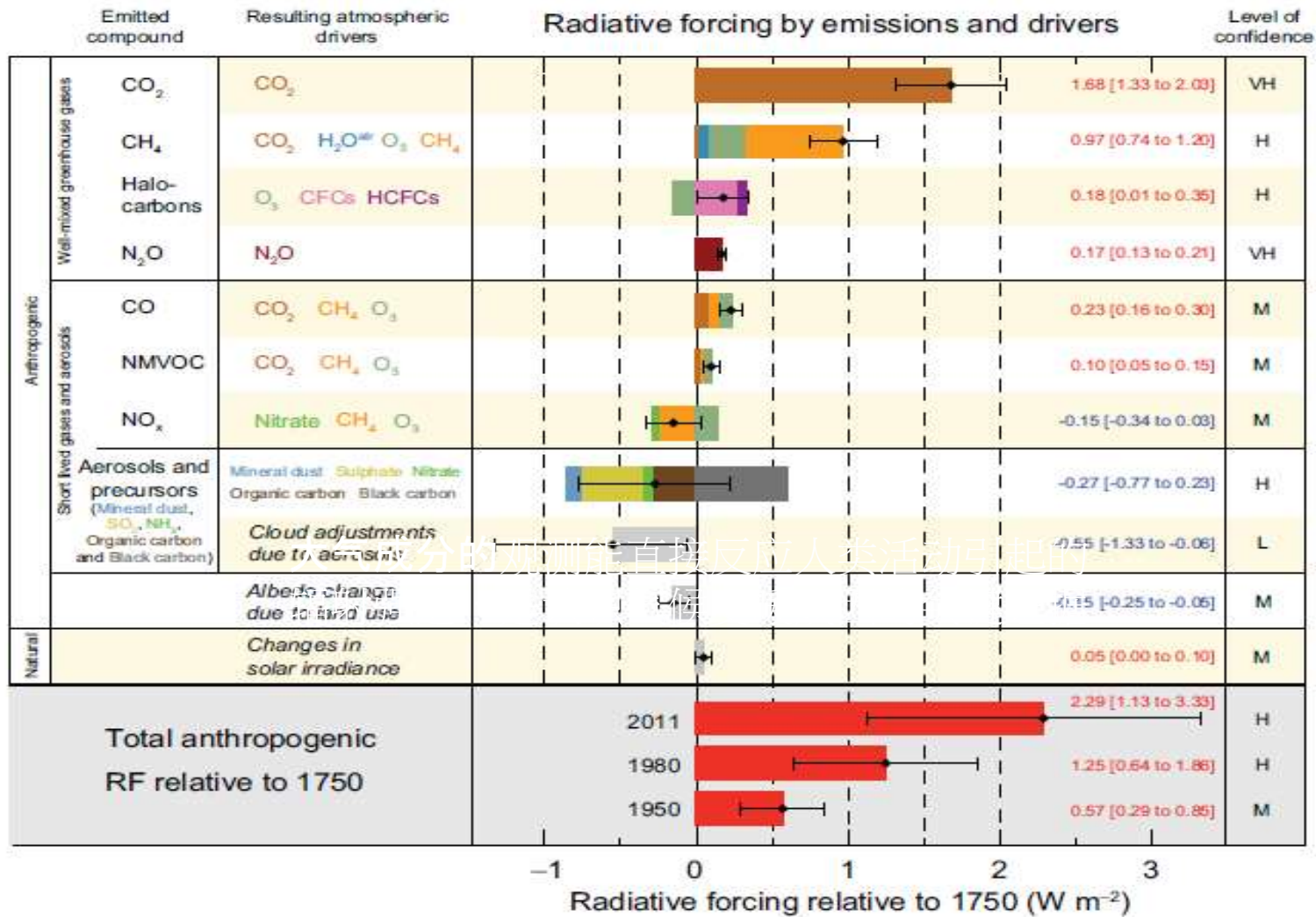
<https://vimeo.com/ipcc>

Data: Scripps/NOAA-ESRL

ipcc

INTERGOVERNMENTAL PANEL ON climate change





Observation of atmospheric component is a key evidence of global warming, which can directly reflect radiative forcing (RF), caused by human emission.