Direkta observationer och paleoklimat

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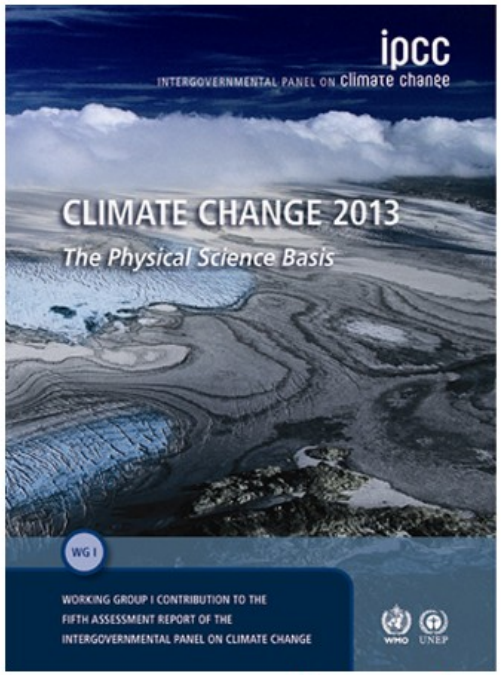
Climate Change 2013: The Physical Science Basis



Summary for Policymakers | Full Report

Quick Links

- More on Working Group I (WGI) report
- Fifth Assessment Report (AR5)
- Background on AR5

Report by Chapters

Technical Summary

- Introduction
- Observations: Atmosphere and Surface
- Observations: Ocean
- Observations: Cryosphere
- Information from Paleoclimate Archives
- Carbon and Other Biogeochemical Cycles
- Clouds and Aerosols
- Anthropogenic and Natural Radiative Forcing
- Evaluation of Climate Models
- Detection and Attribution of Climate Change: from Global to Regional
- Near-term Climate Change: Projections and Predictability
- Long-term Climate Change: Projections, Commitments and Irreversibility
- Sea Level Change
- Climate Phenomena and their Relevance for Future Regional Climate Change

Annex I: Atlas of Global and Regional Climate Projections
Annex II: Climate System Scenario Tables
Annex III: Glossary

Changes to the Underlying Scientific/Technical Assessment (IPCC-XXVI/Doc.4)

Complete Underlying Scientific/Technical Assessment (166MB)

+ Press Release

+ Ordering Publications

>200 text pages, excl. references

>100 figures

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Headline Statements from the Summary for Policymakers

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”Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.”

”Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” (AR4, SPM)

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

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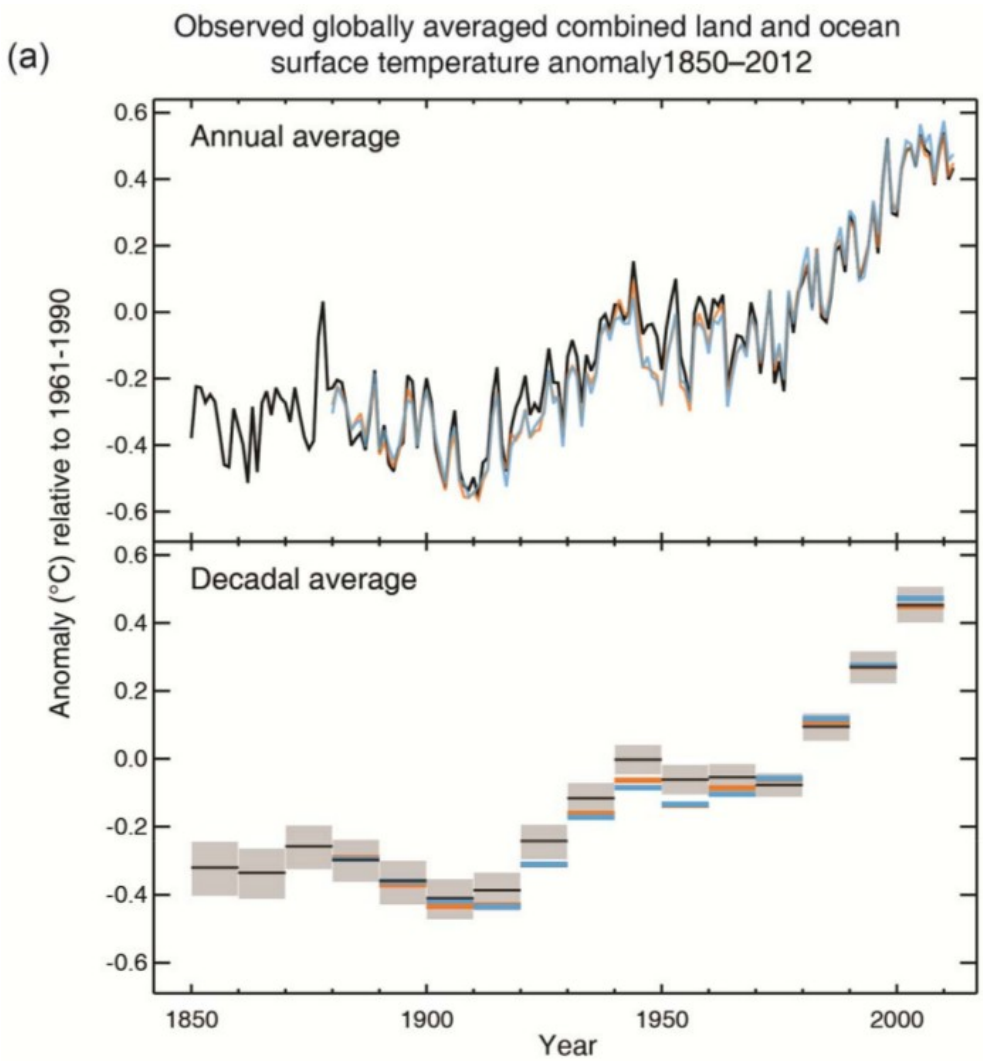

”In addition to robust multi-decadal warming, global mean surface temperature exhibits substantial decadal and interannual variability ...

Due to natural variability ... trends based on short records are very sensitive to the beginning and end dates ...

As one example, the rate of warming over the past 15 years ... which begins with a strong El Niño, is smaller than the rate calculated since 1951...”

(p. SPM-3)

Figure SPM.1

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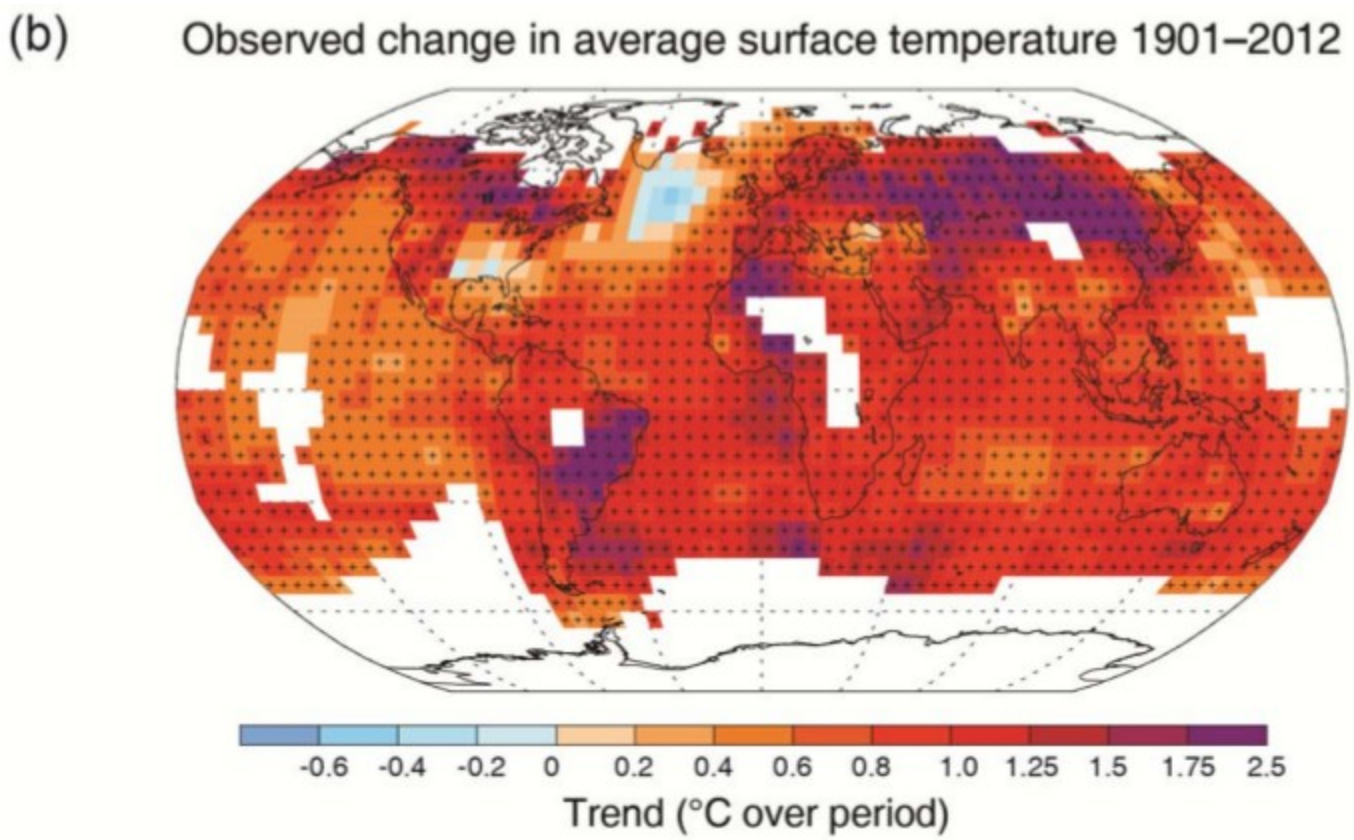

”For the longest period when calculation of regional trends is sufficiently complete (1901–2012), almost the entire globe has experienced surface warming”

(p. SPM-3)

Figure SPM.1

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

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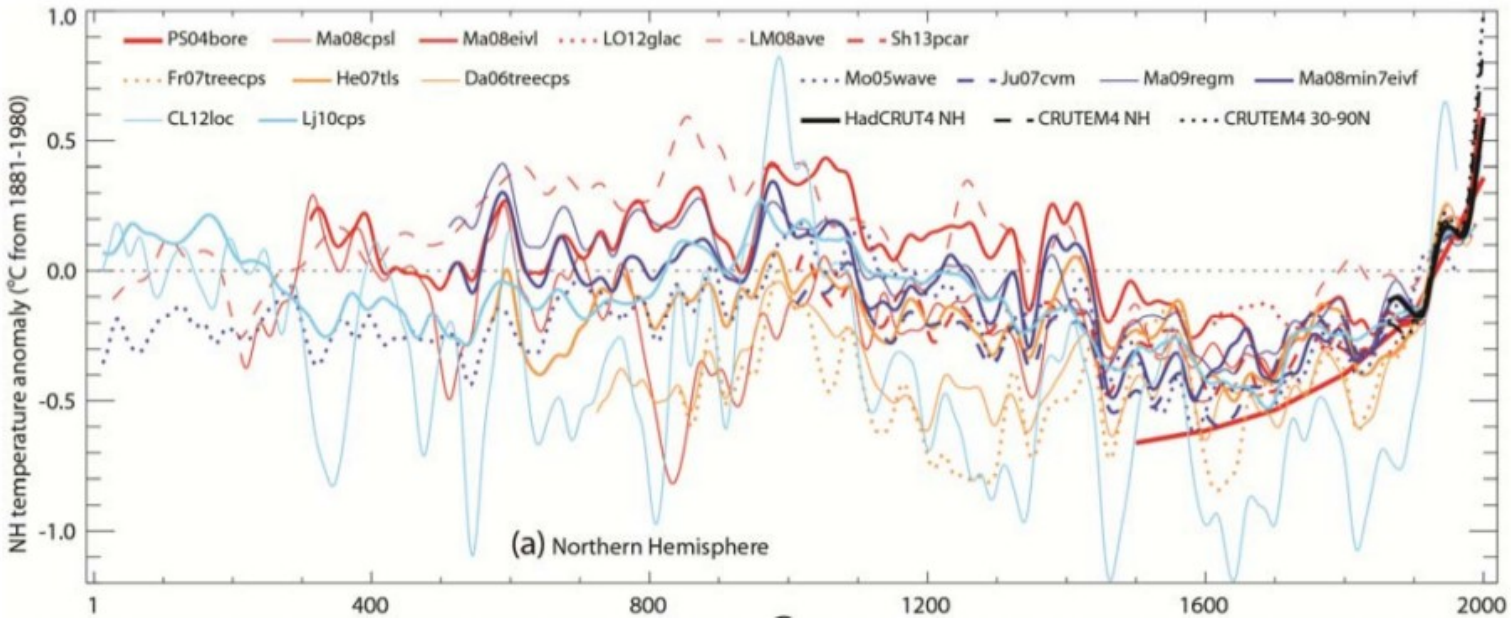

Figure 5.7

”Palaeoclimatic information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1,300 years.” (AR4, SPM)

”For average annual Northern Hemisphere temperatures, the period 1983–2012 was *very likely* the warmest 30-year period of the last 800 years (*high confidence*) and *likely* the warmest 30-year period of the last 1400 years (*medium confidence*). This is supported by comparison of instrumental temperatures with multiple reconstructions from a variety of proxy data and statistical methods, and is consistent with AR4.”

(p. TS-42)

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Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties

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High agreement Limited evidence	*High agreement Medium evidence*	*High agreement Robust evidence*
Medium agreement Limited evidence	*Medium agreement Medium evidence*	*Medium agreement Robust evidence*
Low agreement Limited evidence	*Low agreement Medium evidence*	*Low agreement Robust evidence*

Agreement →

Evidence (type, amount, quality, consistency) →

Confidence scale

Confidence - qualitative

Table 1. Likelihood Scale

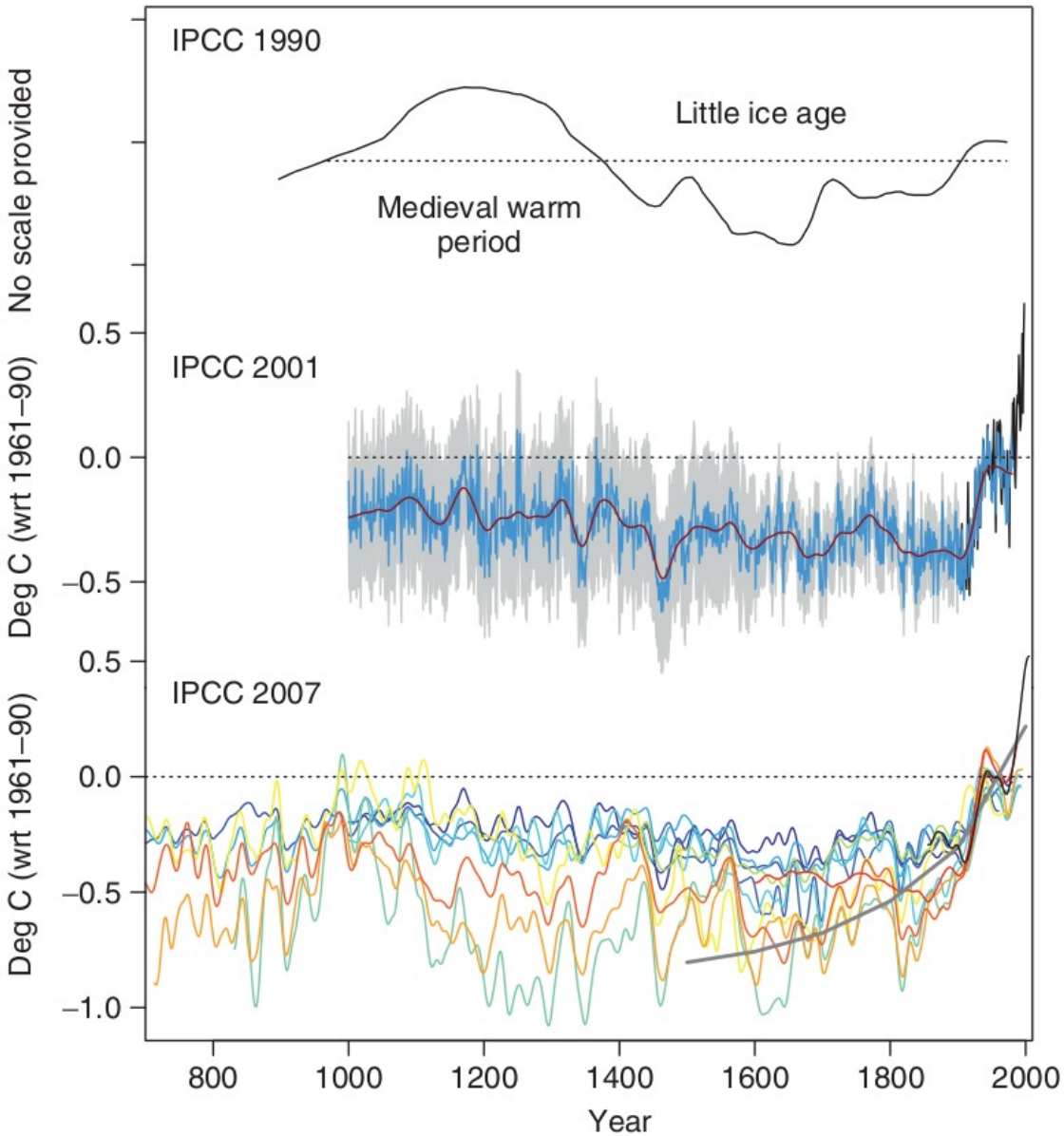
Term*	Likelihood of the Outcome
Virtually certain	99-100% probability
Very likely	90-100% probability
Likely	66-100% probability
About as likely as not	33 to 66% probability
Unlikely	0-33% probability
Very unlikely	0-10% probability
Exceptionally unlikely	0-1% probability

Likelihood - quantitative

* Additional terms that were used in limited circumstances in the AR4 (*extremely likely* – 95-100% probability, *more likely than not* – >50-100% probability, and *extremely unlikely* – 0-5% probability) may also be used in the AR5 when appropriate.

Table 5.4: Comparison of recent hemispheric and global temperature estimates with earlier reconstructed values, using published uncertainty ranges to assess likelihood of unusual warmth. Each reconstructed *N*-year mean temperature within the indicated period is compared with both the warmest *N*-year mean reconstructed after 1900 and with the most recent *N*-year mean instrumental temperature, for $N = 30$ and $N = 50$ years. Blue symbols indicate the periods and reconstructions where the reconstructed temperatures are *very likely* cooler than the post-1900 reconstruction (■), or otherwise *very likely* (✱) or *likely* (☒) cooler than the most recent instrumental temperatures; □ indicates that some reconstructed temperatures were as likely warmer or colder than recent temperatures.

Region:	NH														SH			Global		
Domain:	Land & Sea				Land					Extratropics					Land			Land		
Study:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	7	6	9	7	9	15
50-year means																				
1600–1899	■	✱	✱	■	✱	■	✱	■	■	■	■	■	■	■	✱	■	■	✱	■	■
1400–1899	■	✱	✱	■	✱	■	✱	■		■	■	■	■	■	✱	■		✱		
1200–1899	■	✱	✱	■	✱	■	✱	✱		■	■	✱	■	■	✱	✱		✱		
1000–1899	✱	✱	✱	✱	✱	■	✱	✱		✱	■	✱	■	✱	✱	✱		✱		
800–1899	✱	☒	☒		☒	■	✱			✱	□	✱	■		☒	✱		✱		
600–1899	✱	☒	☒		☒	■	✱			✱	□	✱			☒	✱		✱		
400–1899	✱	☒	□		☒	✱	✱			✱	□				□					
200–1899	✱				☒	✱				✱	□				□					
1–1899	✱									✱	□									
30-year means																				
1600–1899	■	✱	✱	■	✱	■	✱	■	■	■		■	■	■	✱	■	■	✱	■	
1400–1899	■	✱	✱	■	✱	■	✱	■		■		■	■	■	✱	■		✱		
1200–1899	■	✱	✱	■	✱	■	✱	■		■		■	■	■	✱	✱		✱		
1000–1899	✱	✱	✱	✱	✱	■	✱	✱		✱		■	■	✱	✱	✱		✱		
800–1899	✱	✱	✱		✱	■	✱			✱		■	■		✱	✱		✱		
600–1899	✱	✱	✱		✱	■	✱			✱		■			✱	✱		✱		
400–1899	✱	✱			✱	✱	✱			✱					✱					
200–1899	✱				✱	✱				✱					✱					
1–1899	✱									✱										



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A noodle, hockey stick, and spaghetti plate: a perspective on high-resolution paleoclimatology

David Frank,[1*] Jan Esper,[2] Eduardo Zorita[3] and Rob Wilson[4]

WIREs CLIMATE CHANGE

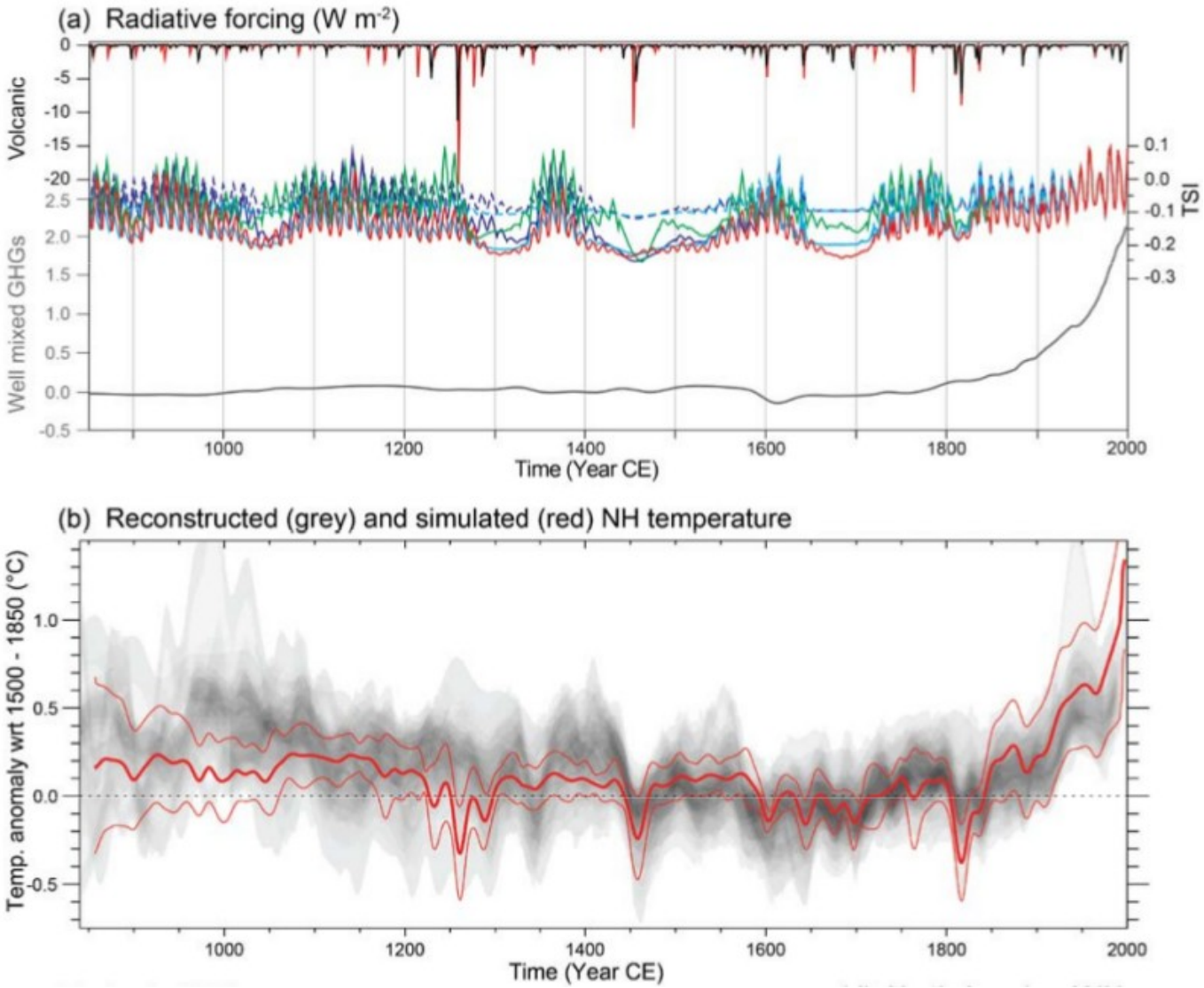
2010

"Many in the palaeoclimatic community have known that the IPCC (1990) graph was not representative of global conditions (even when it first appeared) and hence the reference to it as a schematic.

... the source can be isolated to a series used by H.H. Lamb, representative of central England"

(Jones et al. 2009,
The Holocene, 19, 3-49, Appendix A)

NH reconstructions & PMIP3/CMIP5 simulations



”Based on the comparison between reconstructions and simulations, there is *high confidence* that not only external orbital, solar and volcanic forcing but also internal variability contributed substantially to the spatial pattern and timing of surface temperature changes between the Medieval Climate Anomaly [ca. 950 to 1250] and the Little Ice Age (ca. 1450 to 1850).

However, there is only *very low confidence* in quantitative estimates of their relative contributions.

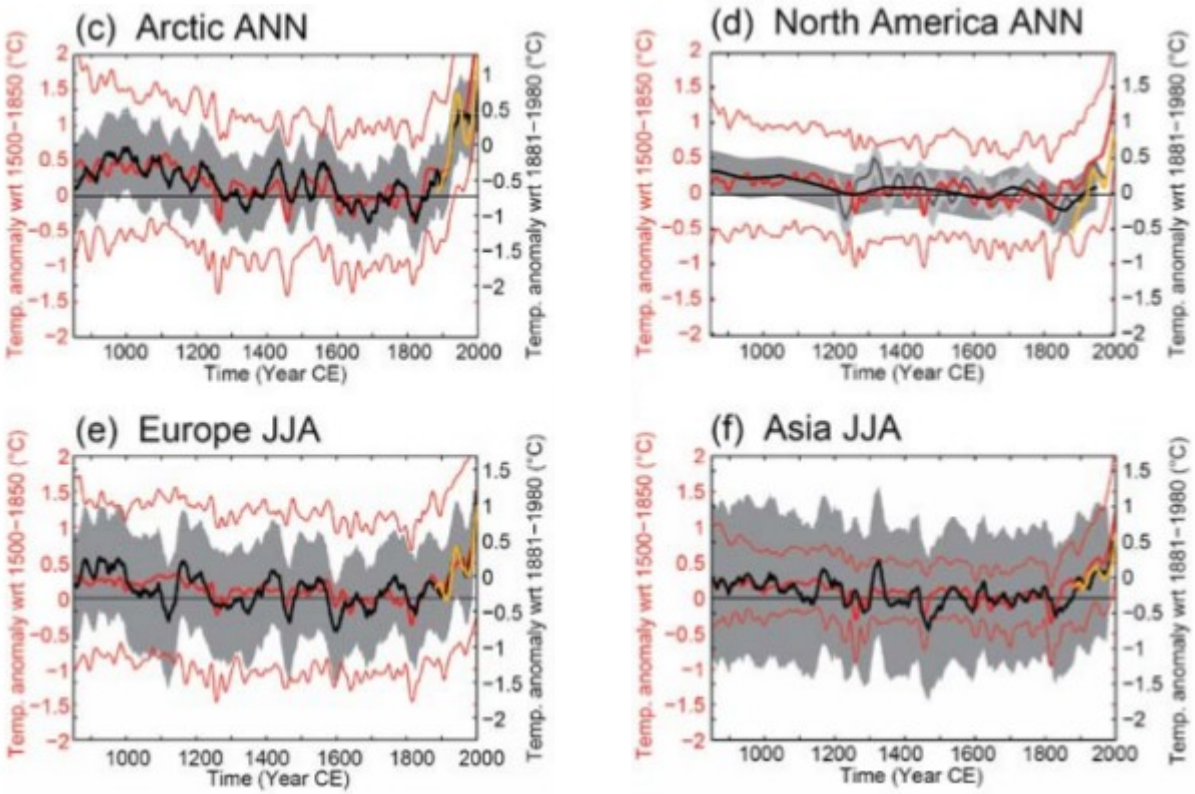
It is *very unlikely* that northern hemisphere temperature variations from 1400 to 1850 can be explained by internal variability alone.”

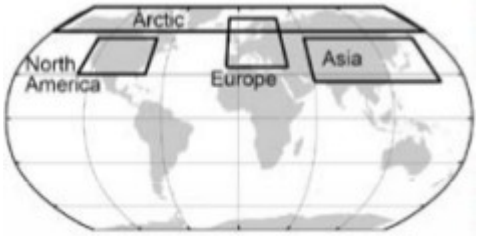
(p. TS-42)

Box TS.5, Figure 1

”Continental-scale surface temperature reconstructions show, with *high confidence*, multi-decadal periods during the Medieval Climate Anomaly (year 950 to 1250) that were in some regions as warm as in the late 20th century. These regional warm periods did not occur as coherently across regions as the warming in the late 20th century (*high confidence*)”

(p. SPM-4)





Box TS.5, Figure 1

"*Confidence* in precipitation change averaged over global land areas since 1901 is *low* prior to 1951 and *medium* afterwards. Averaged over the mid-latitude land areas of the Northern Hemisphere, precipitation has increased since 1901 (*medium confidence* before and *high confidence* after 1951). For other latitudes area-averaged long-term positive or negative trends have *low confidence*." (p. SPM-4)

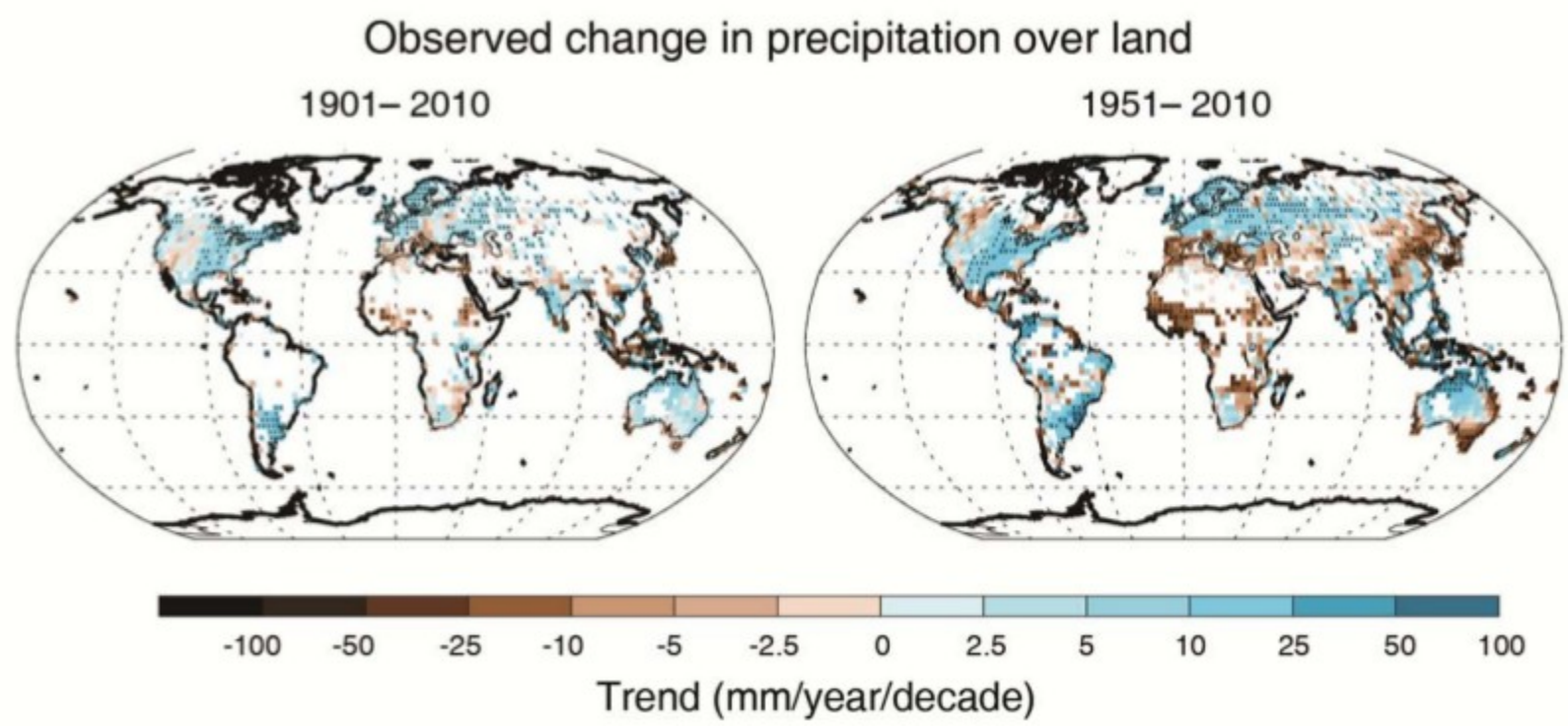


Figure SPM.2

”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*). It is *virtually certain* that the upper ocean (0–700 m) warmed from 1971 to 2010, and it *likely* warmed between the 1870s and 1971.”

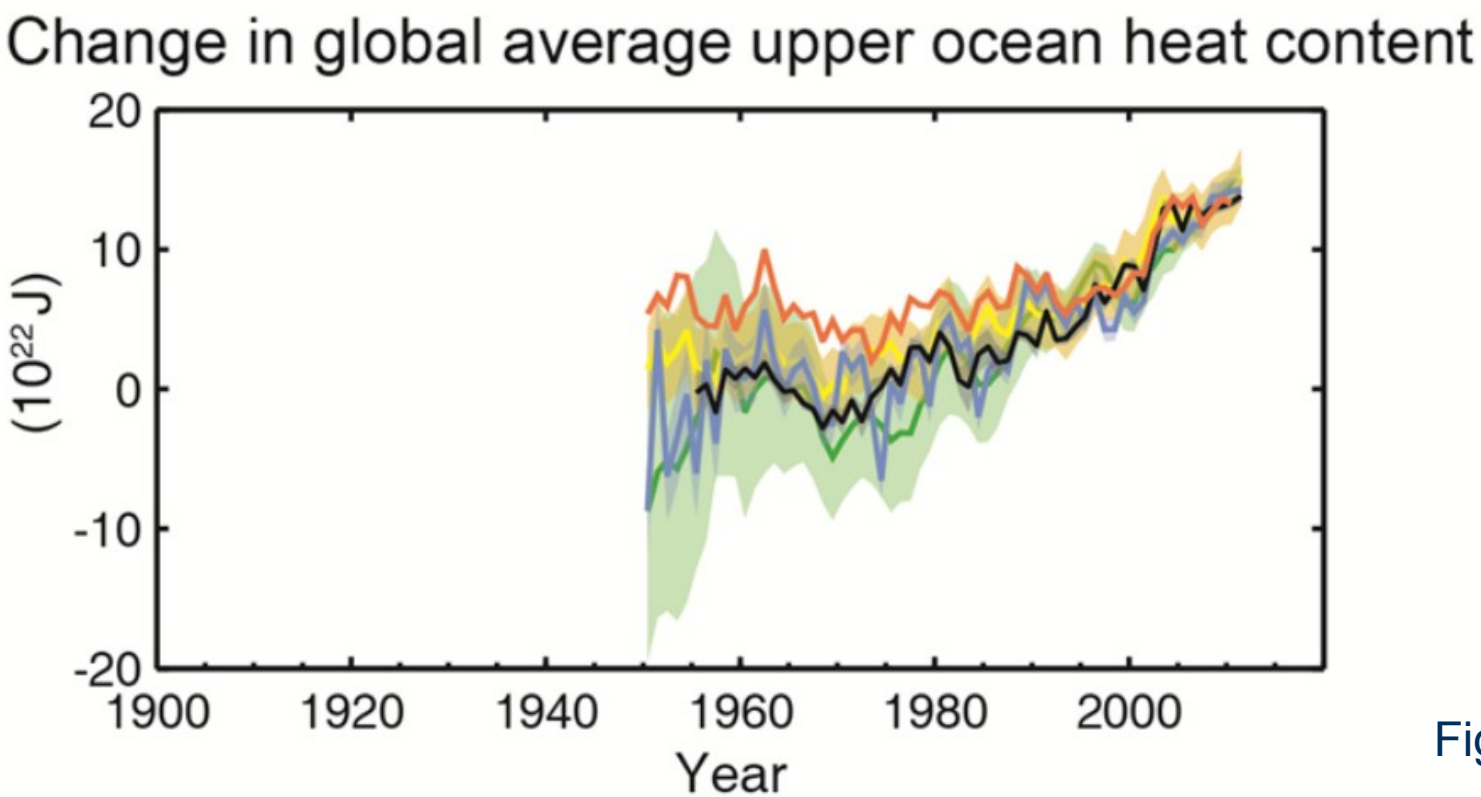
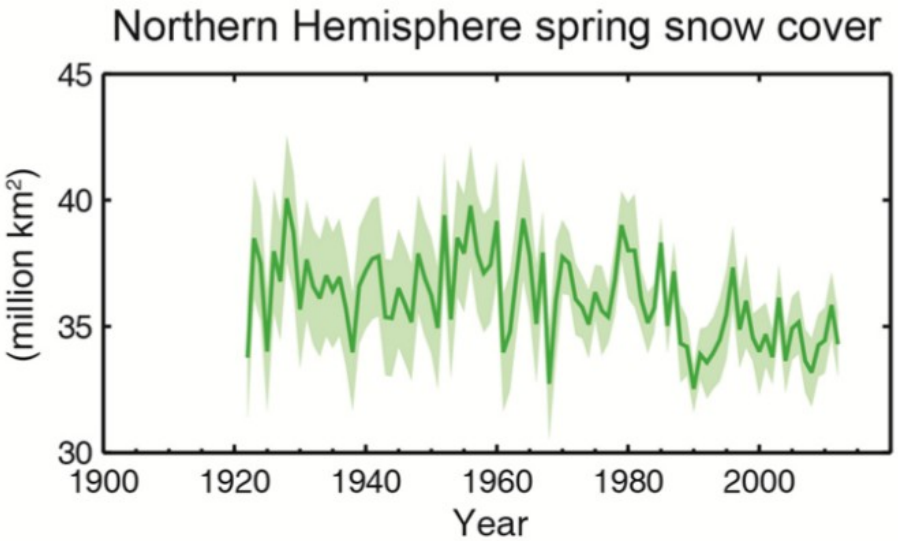


Figure SPM.3c

”Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent (*high confidence*).”



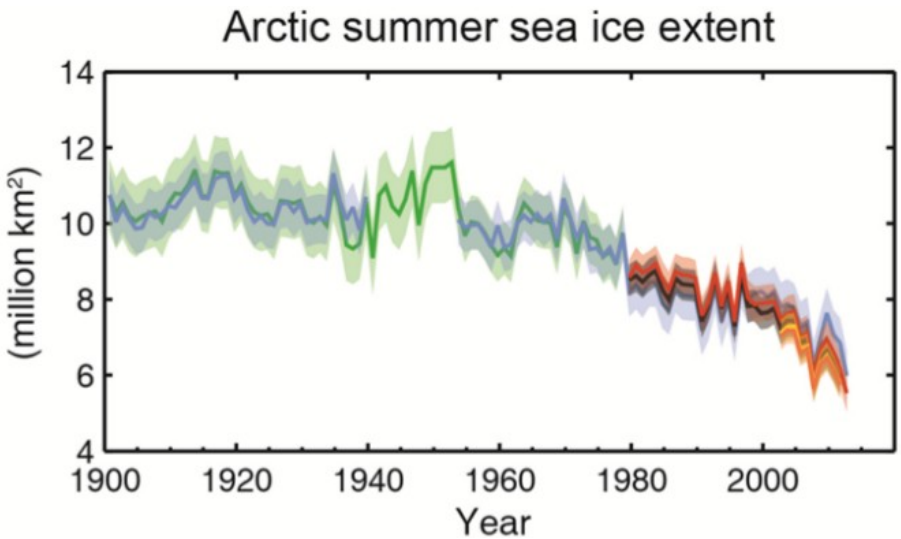
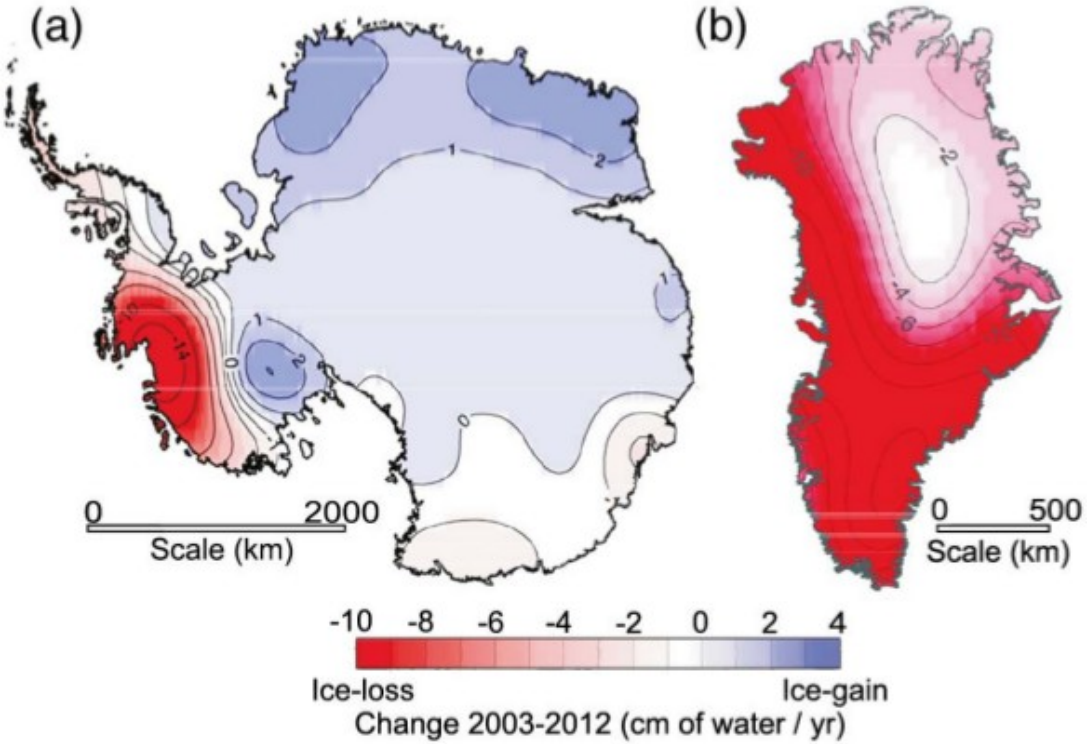
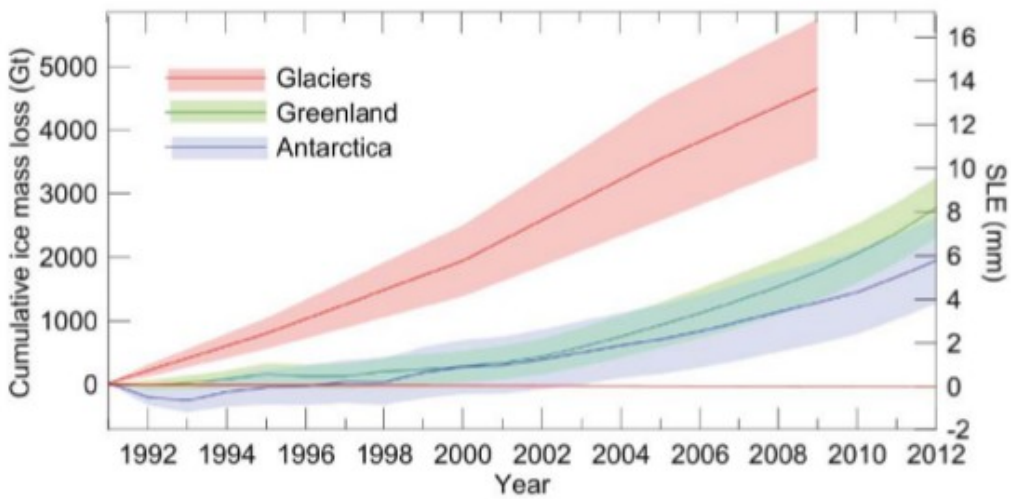


Figure SPM.3a-b





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”There is *very high confidence* that the Greenland Ice Sheet has lost ice during the last two decades.

Combinations of satellite and airborne remote sensing together with field data indicate with *high confidence* that the ice loss has occurred in several sectors and that large rates of mass loss have spread to wider regions than reported in AR4...

There is *high confidence* that the mass loss of the Greenland Ice Sheet has accelerated since 1992...

There is *high confidence* that ice loss from Greenland resulted from increased surface melt and runoff, and increased outlet glacier discharge, and these occurred in similar amounts.

There is *high confidence* that the area subject to summer melt has increased over the last two decades.”

(page TS-9)

Figure TS.3

”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*). Over the period 1901–2010, global mean sea level rose by 0.19 [0.17 to 0.21] m.”

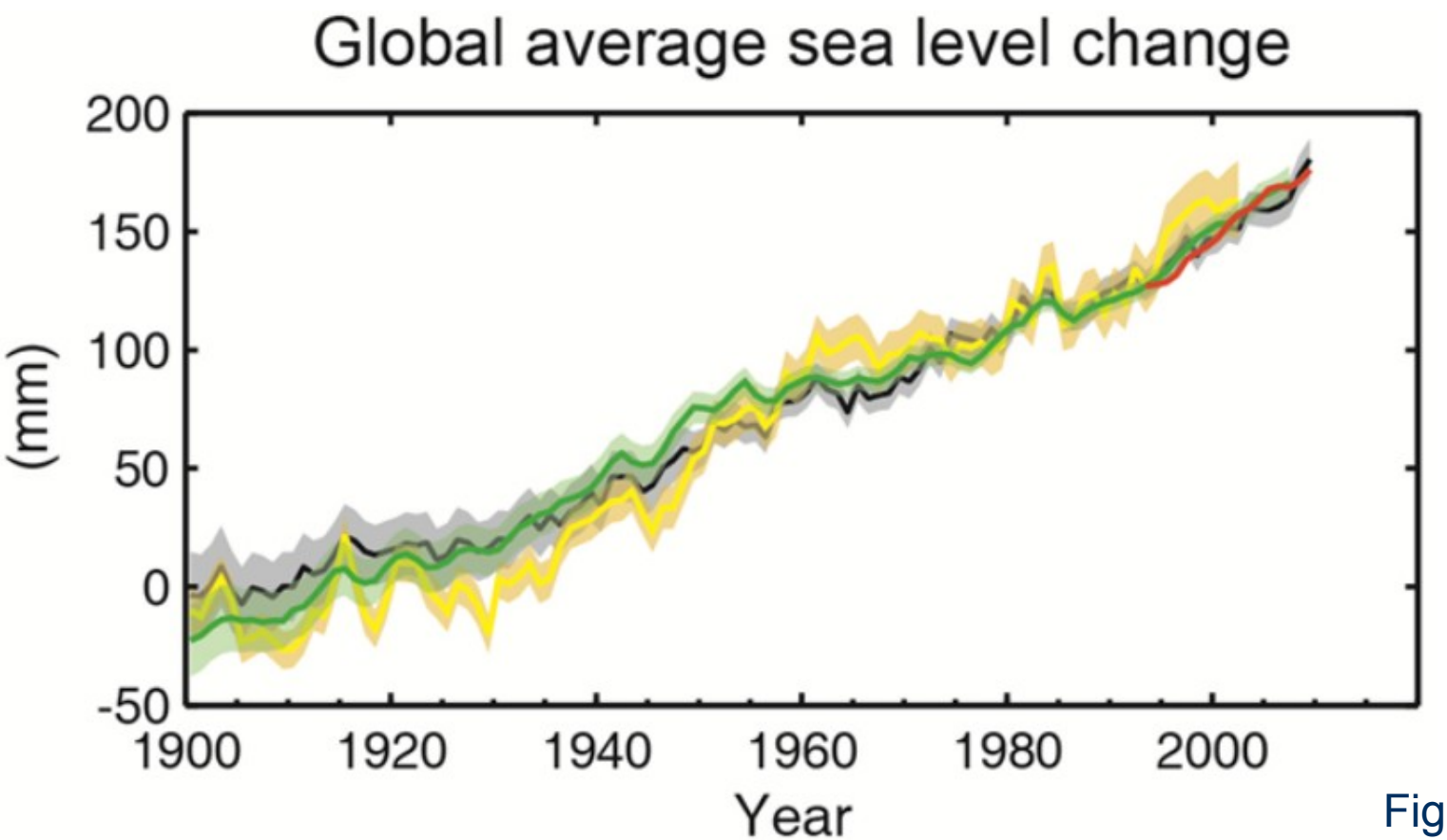

Figure SPM.3d