

# Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

## Understanding and attributing recent climate change

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IPCC Plenary Day 2

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# Observed decadal mean warming

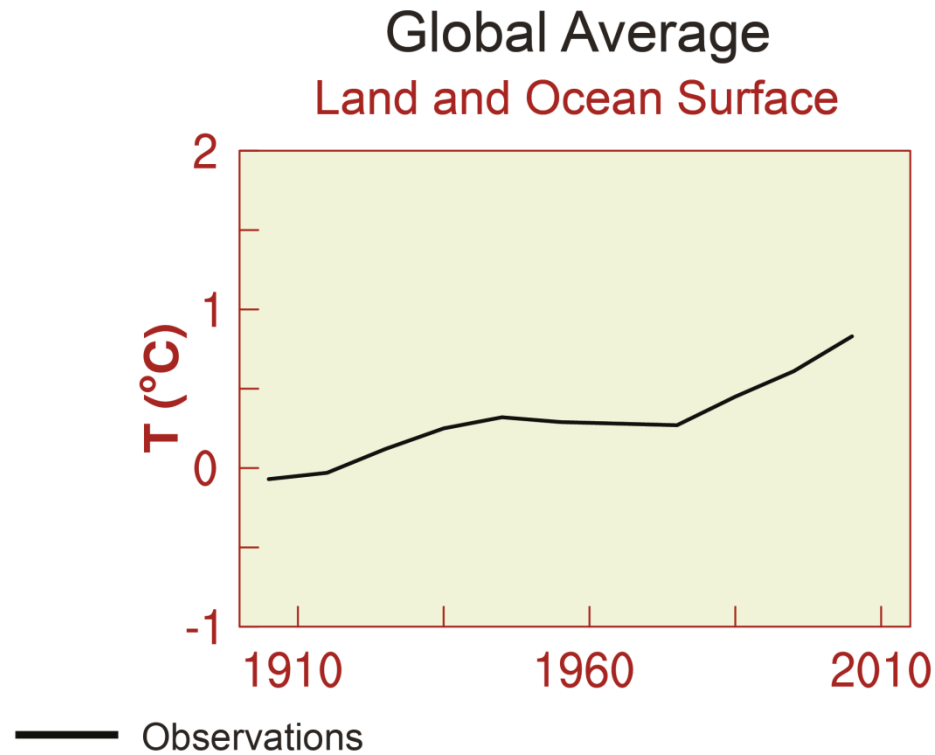


Fig SPM.5

# Observed warming inconsistent with that expected from natural factors

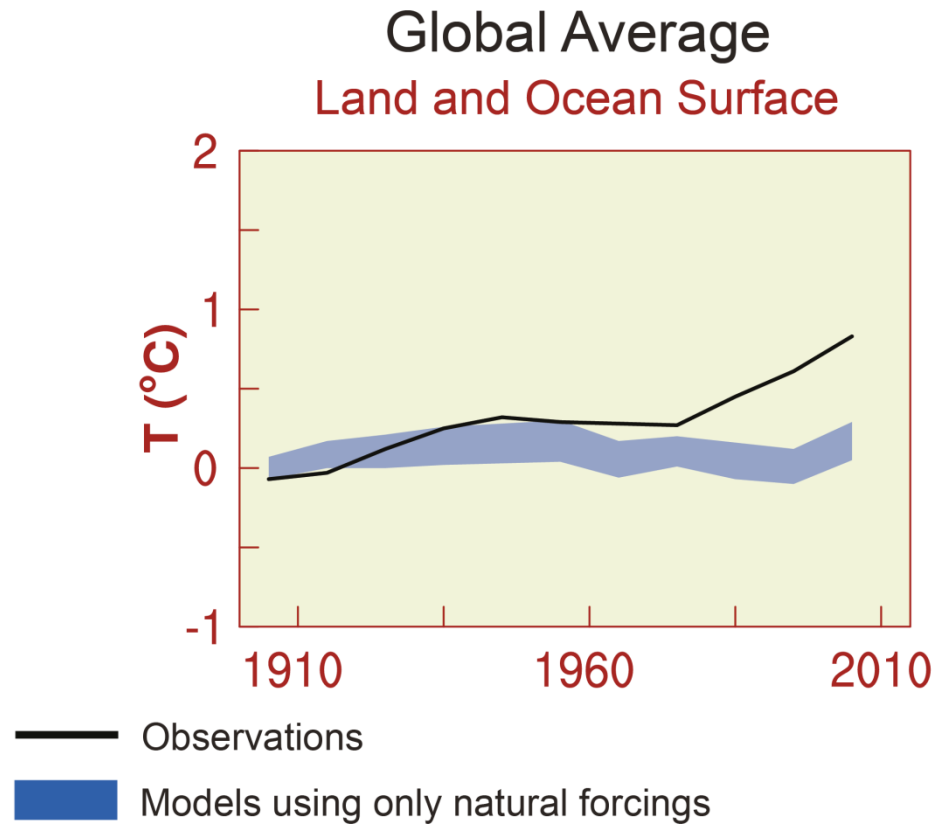


Fig SPM.5

# Observed warming consistent with simulations that include anthropogenic factors

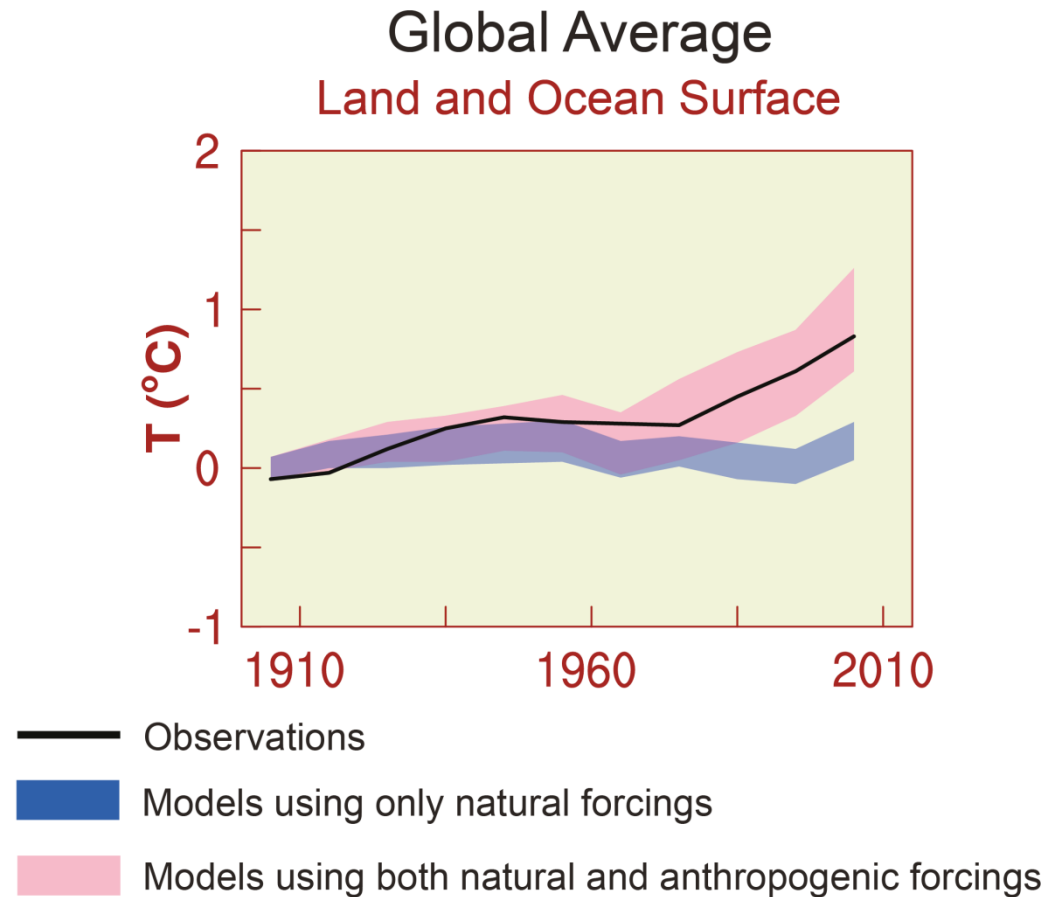


Fig SPM.5

# Attribution of warming to human influence in many continental regions

Over every continental region except Antarctica anthropogenic forcings have *likely* made a substantial contribution to surface temperature increases since the mid-20<sup>th</sup> century.

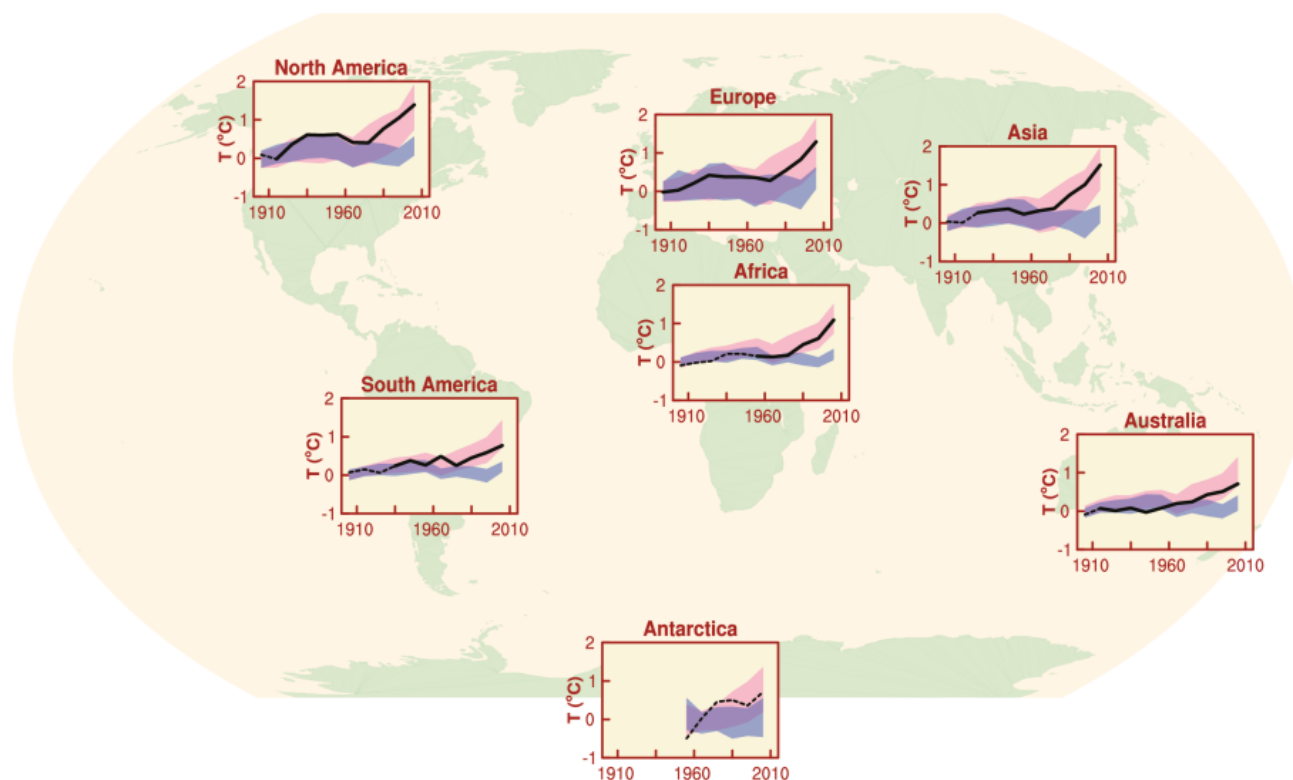


Fig SPM.5

# Quantification of human influence on observed warming since the mid-20<sup>th</sup> century

Attribution studies based on different methodologies, a new generation of climate models and observations to 2010.  
Anthropogenic contribution *extremely likely* more than half the observed warming.

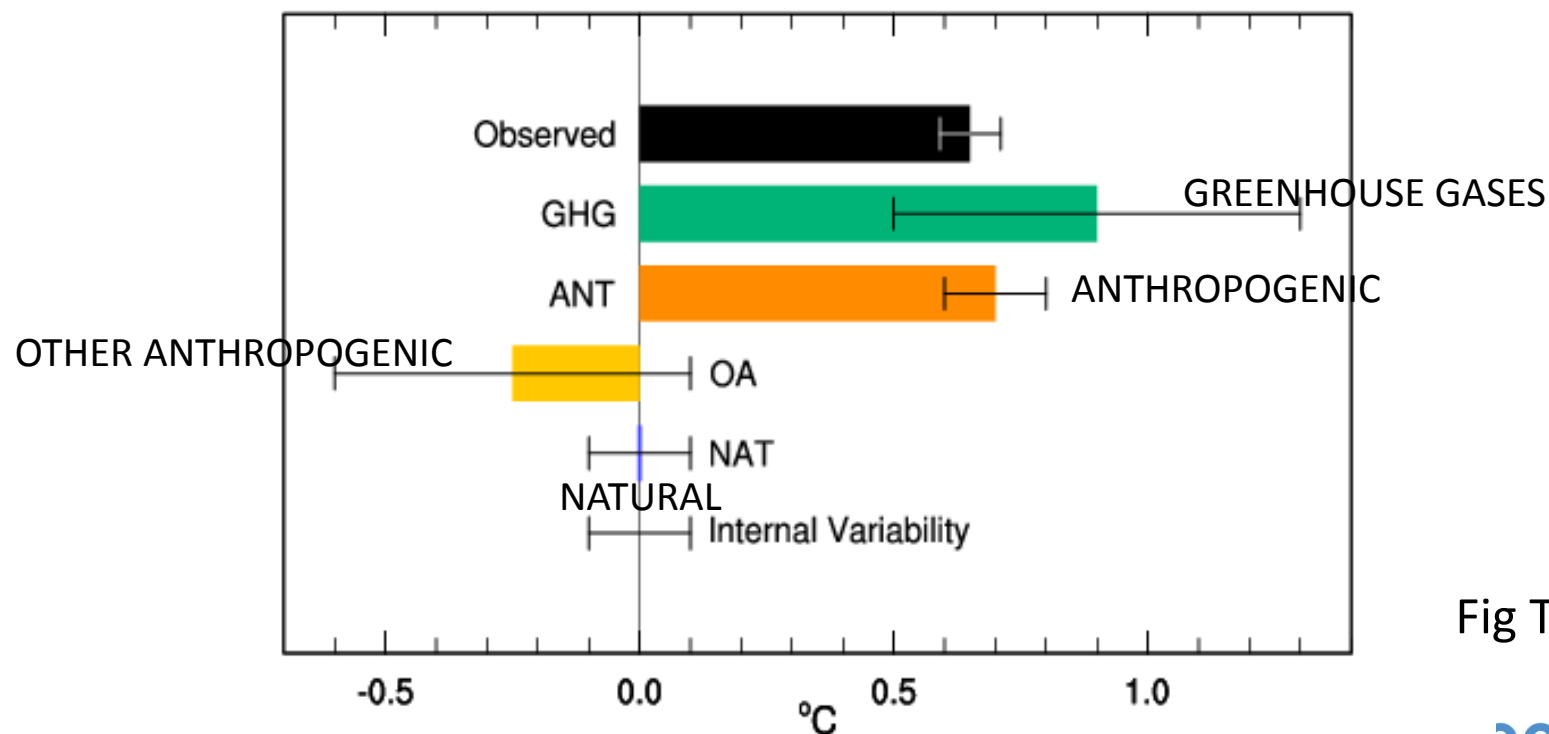


Fig TS.10

# Observed warming consistent with that expected from anthropogenic factors and inconsistent with that expected from natural factors

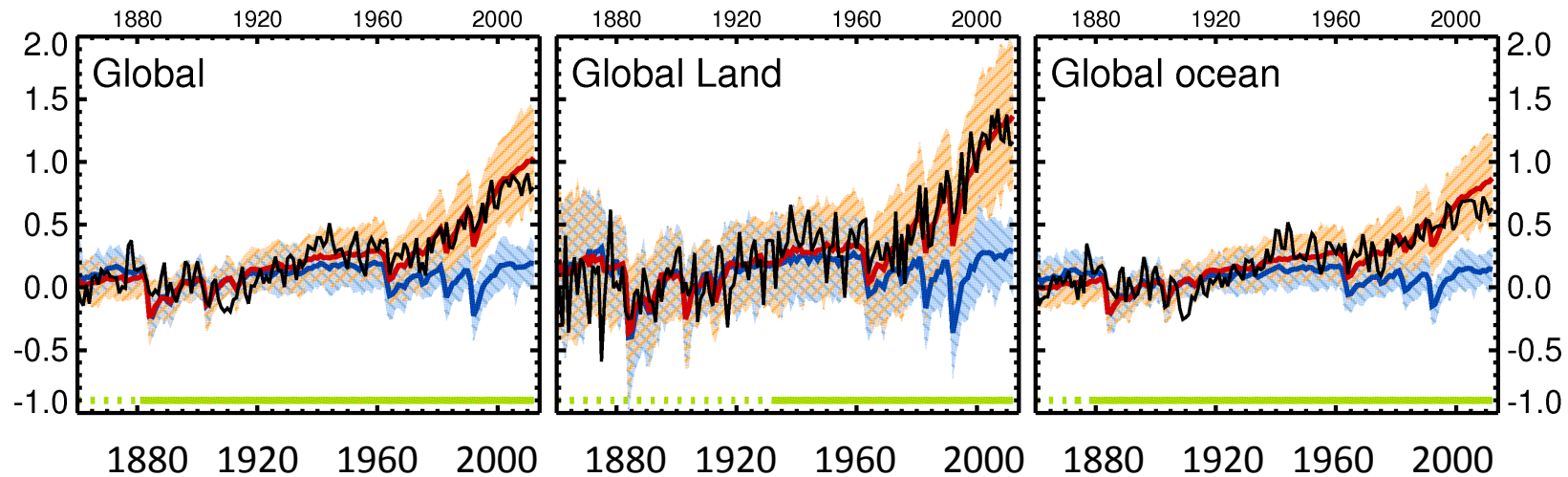


Fig 10.7

The first decade of the 21<sup>st</sup> century has been the warmest on record.

# The warming of the last 15 years has been lower than the long term trend

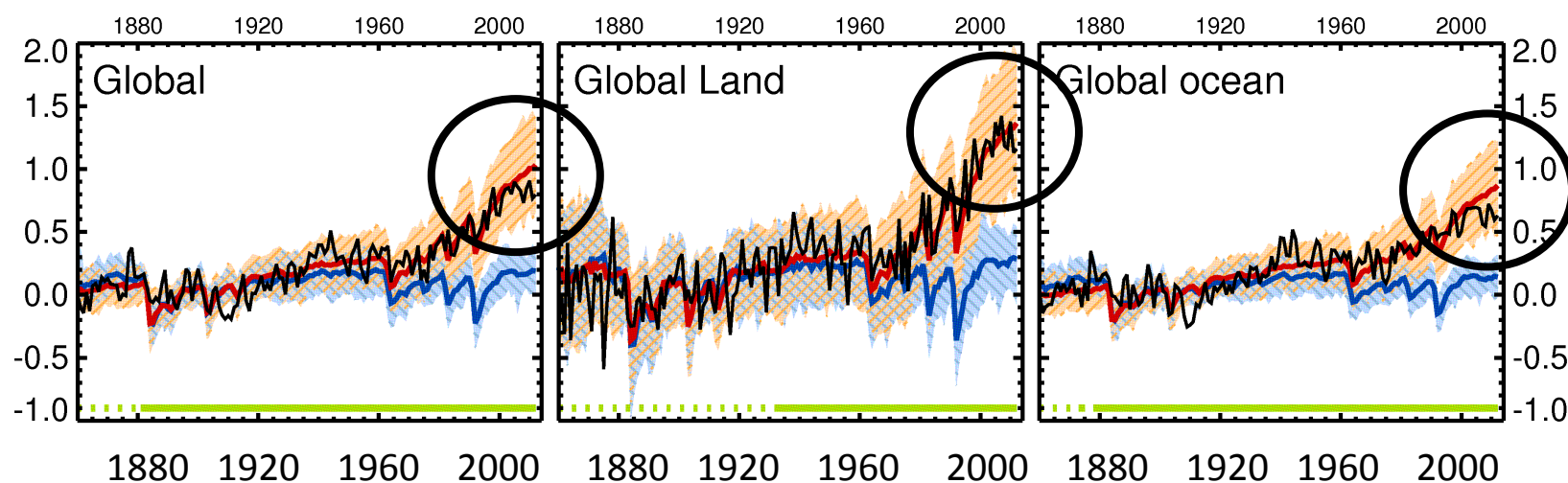


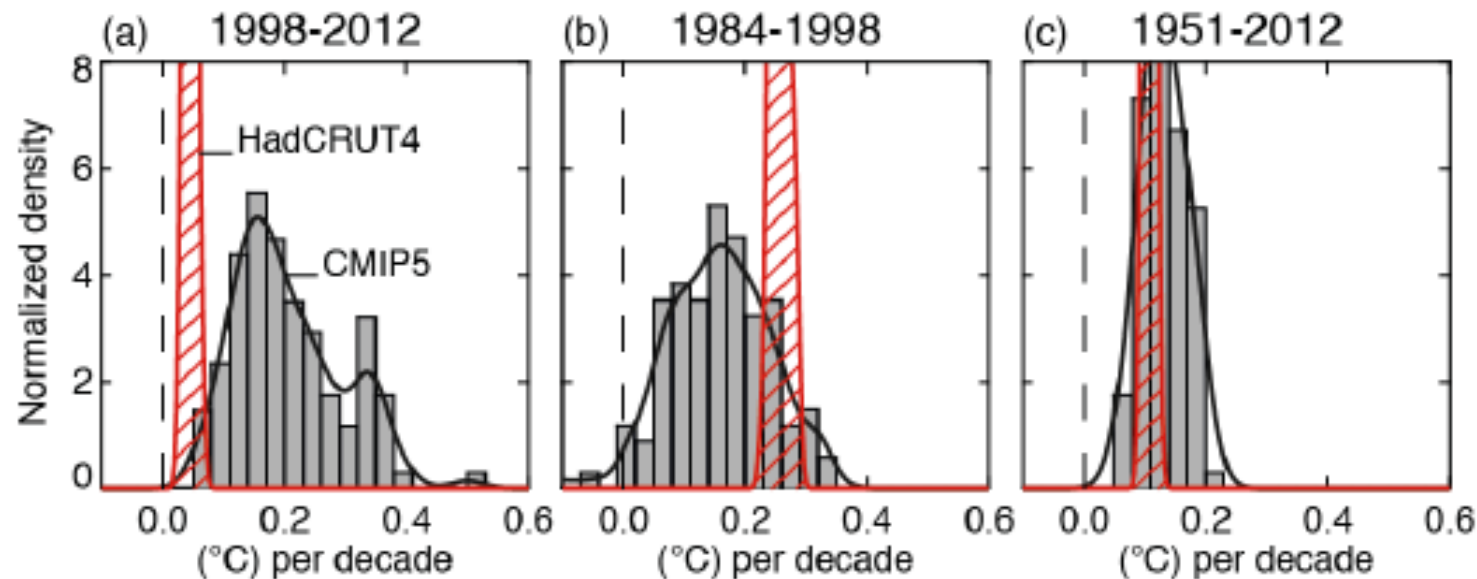
Fig 10.7

The rate of warming over the past 15 years (1998-2012;  $0.05^{\circ}\text{C}/\text{decade}$ ) has been smaller than since 1951 ( $0.12^{\circ}\text{C}/\text{decade}$ )



# Periods of little or no warming can arise from internal variability

Internal variability causes to a substantial degree the difference between the observations and the simulations (*medium confidence*).



Box TS.3 Fig 1

# Evidence for a reduced forcing trend from 1998 compared to from 1951

- The reduced trend in radiative forcing is primarily due to volcanic eruptions and the downward phase of the solar cycle.

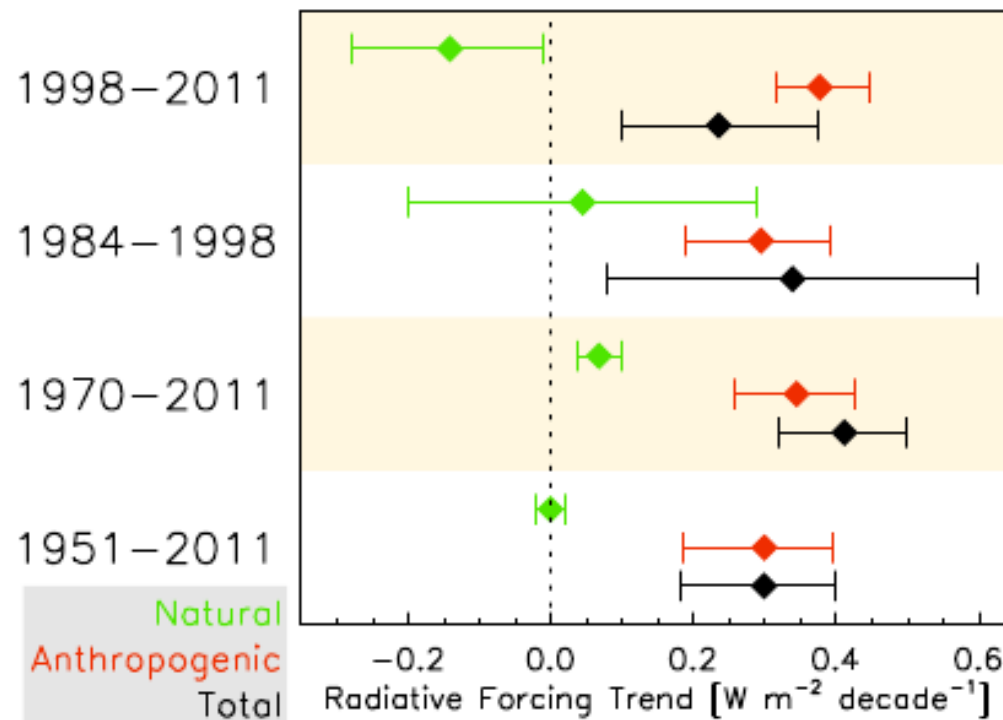


Fig 8.19

Reduced warming trend is due in roughly equal measure to a reduced trend in radiative forcing and a cooling contribution from internal variability (*medium confidence*)

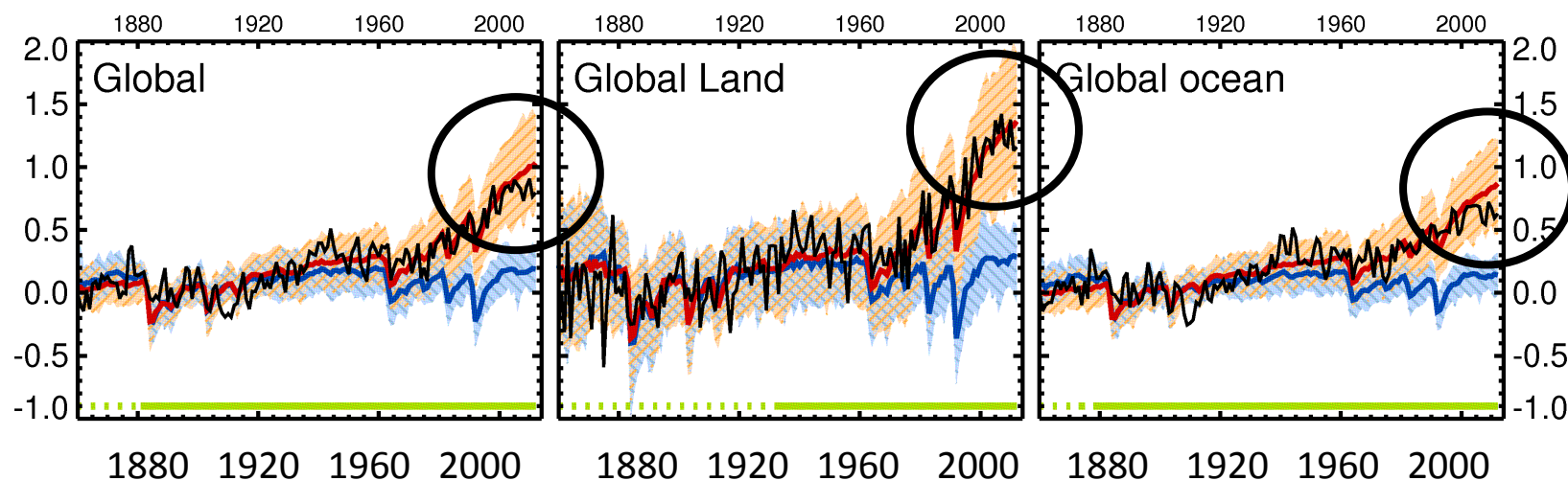
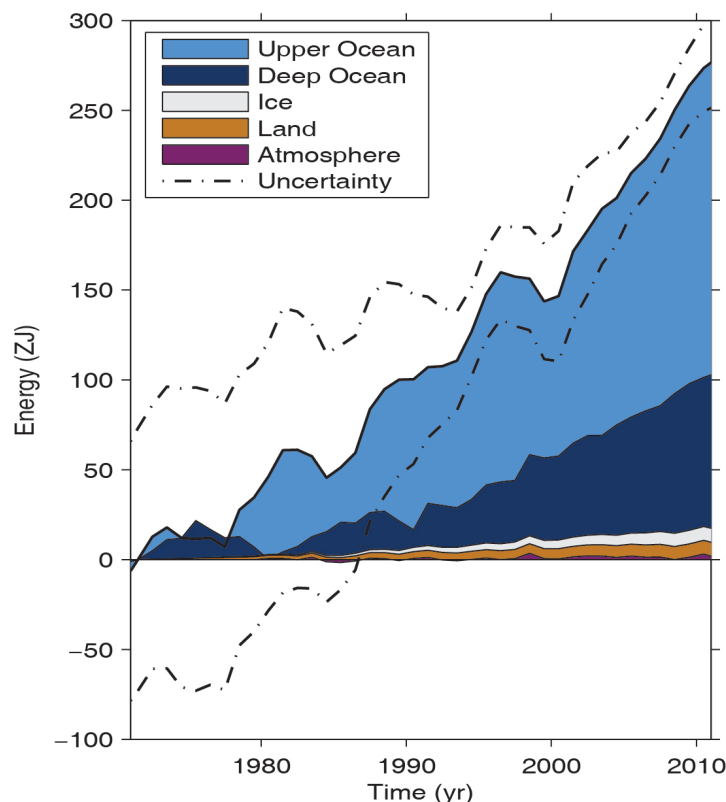


Fig 10.7

The rate of warming over the past 15 years (1998-2012;  $0.05^{\circ}\text{C}/\text{decade}$ ) has been smaller than since 1951 ( $0.12^{\circ}\text{C}/\text{decade}$ )

# The climate system has continued to accumulate energy during the last 15 years

- *Very likely* that climate system including the ocean below 700m depth has continued to accumulate energy over the last 15 years.
- This is consistent with positive radiative imbalance of the climate system.



Box 3.1 Fig 1

# Anthropogenic influences on the global water cycle

- Anthropogenic influences have contributed to:
  - Observed increases in atmospheric moisture (*medium confidence*)
  - Global-scale precipitation patterns over land (*medium confidence*)
  - Intensification of heavy precipitation over land regions where data is sufficient (*medium confidence*)

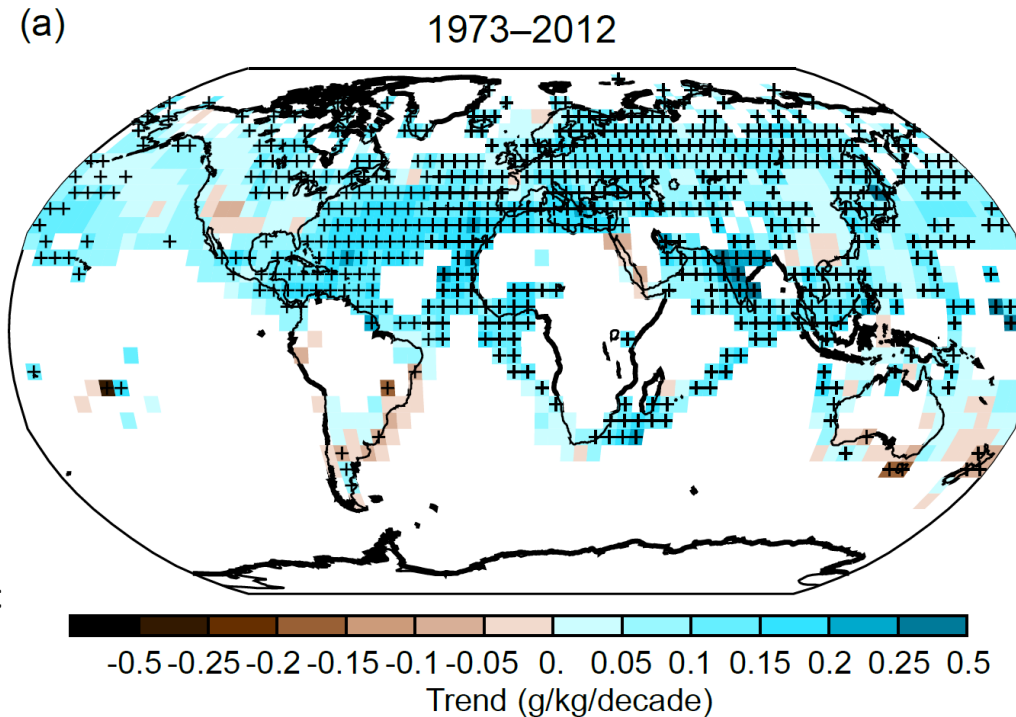


Fig 2.30

# It is *likely* that anthropogenic influences have affected the global water cycle

- It is *very likely* that anthropogenic forcings have contributed to ocean salinity changes
  - Making fresher regions fresher over time and saltier regions saltier

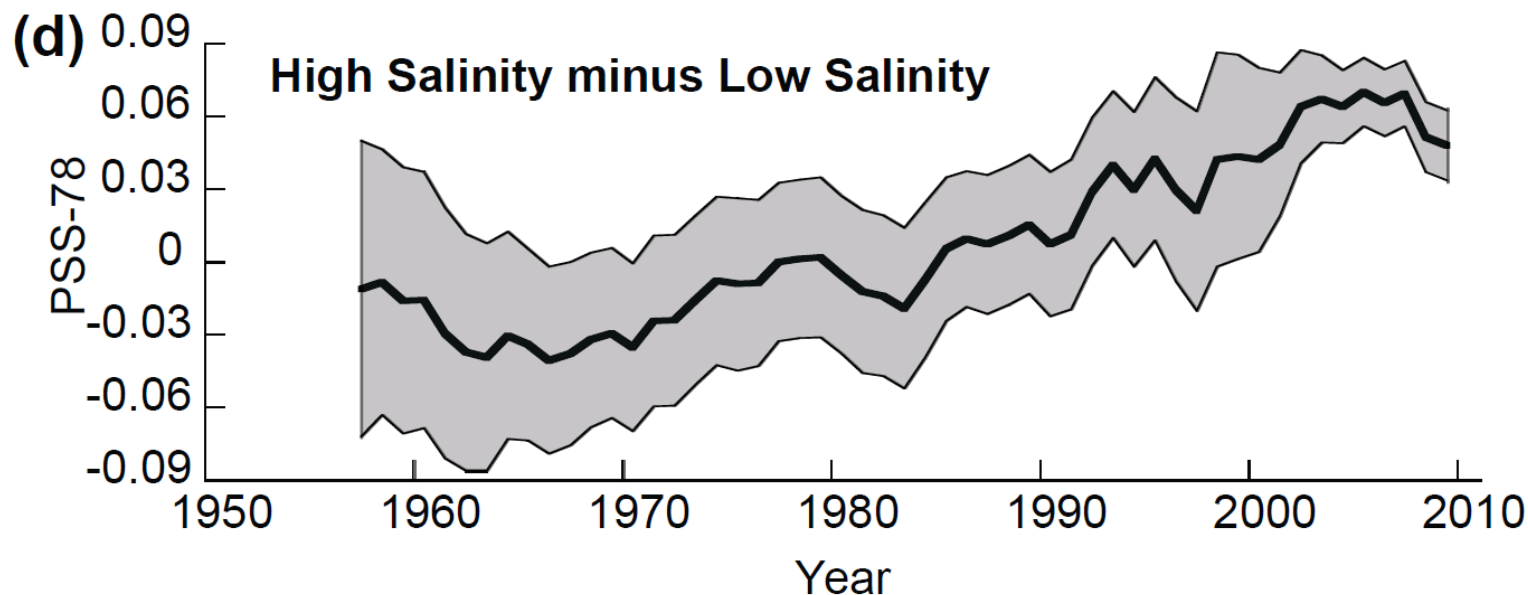


Fig 3.21

Changed ocean salinity

# Strengthening of evidence for human influence on climate since AR4

- Studies consider the first decade of the 21<sup>st</sup> century and a new generation of climate models
- Multiple studies using different methods produce consistent results and strengthen confidence in the quantification of anthropogenic warming.
- There is higher confidence than at AR4 for a human influence on
  - Ocean warming
  - Changes in the global water cycle
  - Melting snow and ice
  - Sea level rise
  - Temperature extremes

# Strengthening of evidence for human influence on climate since AR4

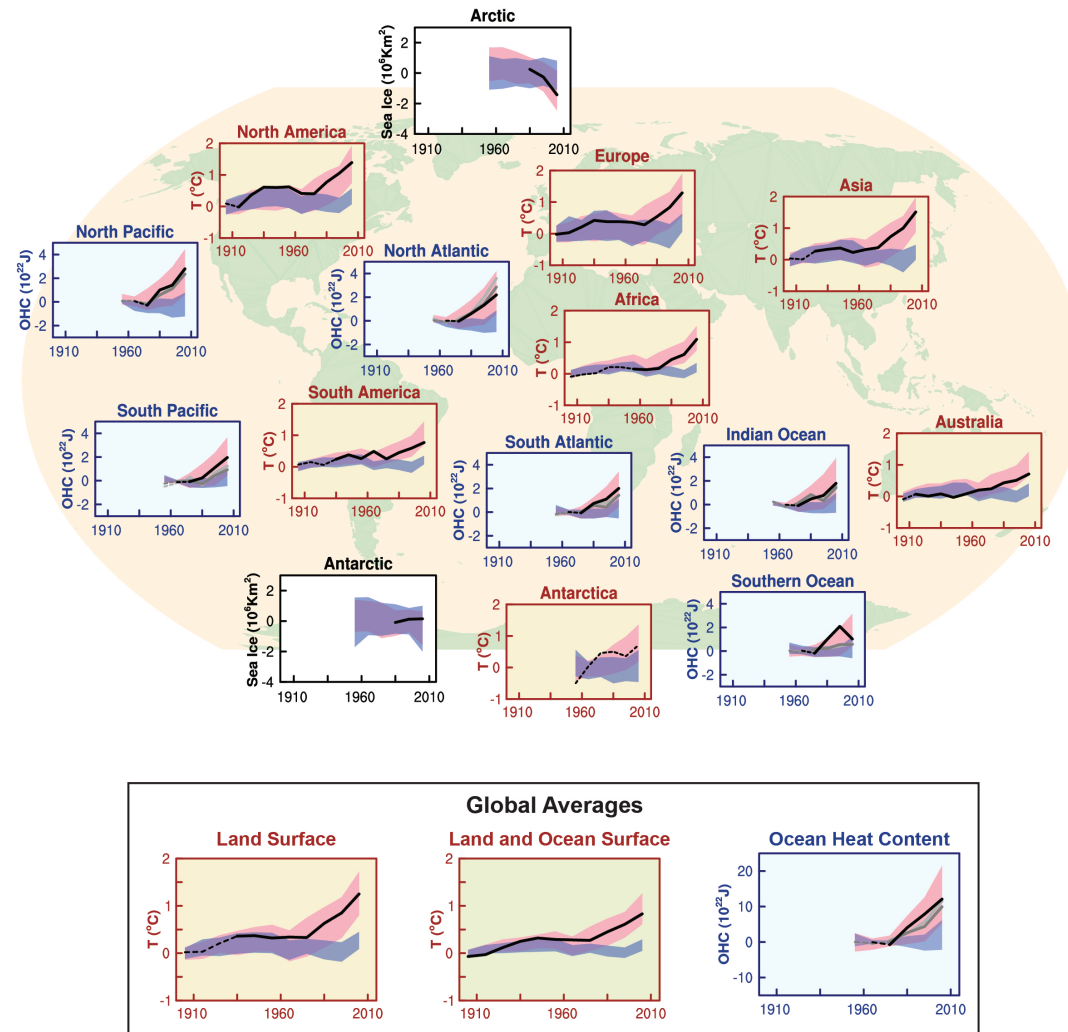


Fig SPM.5



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Further Information  
[www.climatechange2013.org](http://www.climatechange2013.org)

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