

# Climate Change 2013: The Physical Science Basis

Working Group I contribution to the IPCC Fifth Assessment Report

COP 19: Structured Expert Dialogue 2

## Overarching WGI findings relevant to the SED

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# Questions

- ❖ What are the key messages from AR5 WGI relevant for the review?
- ❖ What does AR5 WGI tell us about the relationship between GHG emissions, atmospheric concentrations and change in the climate system?
- ❖ How reliable are the projections made using climate models (e.g., equilibrium/transient, timeline of 2100-2300)?

Key SPM Messages

# 19 Headlines

on less than 2 Pages

Summary for  
Policymakers

ca. 14,000 words

14 Chapters, Atlas

> 1,140,000 words

ipcc

INTERGOVERNMENTAL PANEL ON climate change

## CLIMATE CHANGE 2013

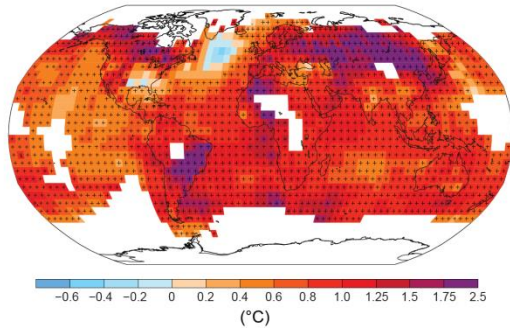
*The Physical Science Basis*

WG I

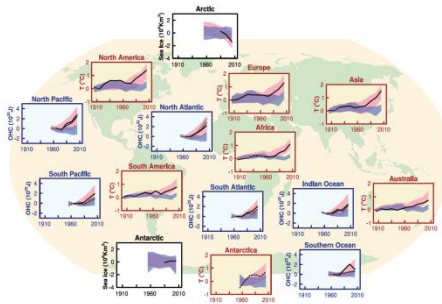
WORKING GROUP I CONTRIBUTION TO THE  
FIFTH ASSESSMENT REPORT OF THE  
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



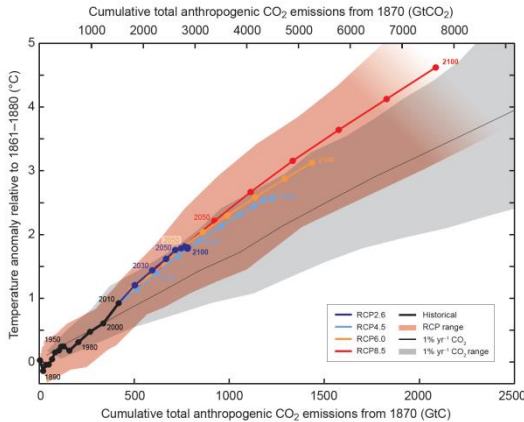
Observed change in surface temperature 1901–2012



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



Human influence on the climate system is clear.



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

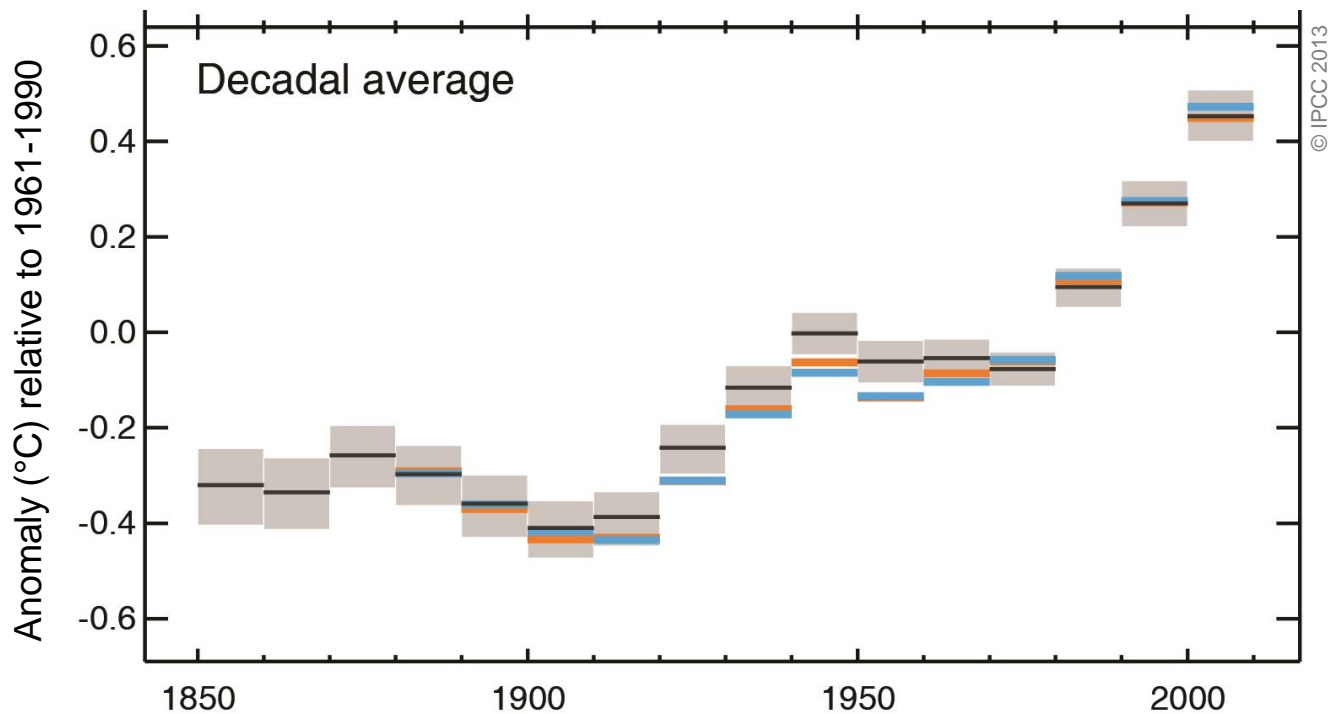


Fig. SPM.1a

The globally averaged, [..] surface temperature data [..] show a warming of 0.85 [0.65 to 1.06] °C over the period 1880–2012.

.. the observed warming to the reference period 1986–2005 is 0.61 [0.55 to 0.67] °C for 1850–1900 ...

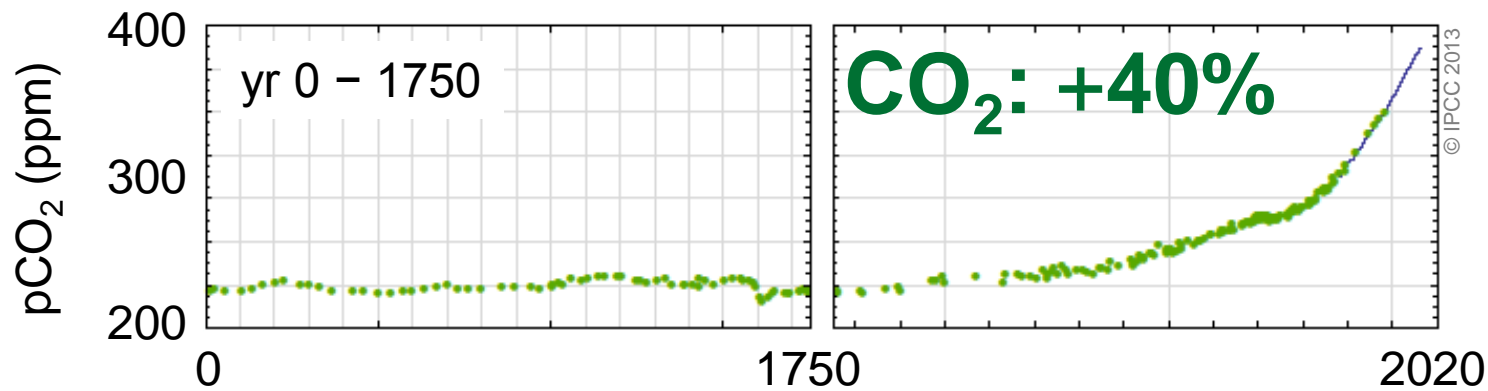


Fig. 6.11

From 1750 to 2011, CO<sub>2</sub> emissions from fossil fuels have released 375 GtC to the atmosphere, while deforestation [...] have released 180 GtC.

This results in cumulative anthropogenic emissions of 555 [470 to 640] GtC.

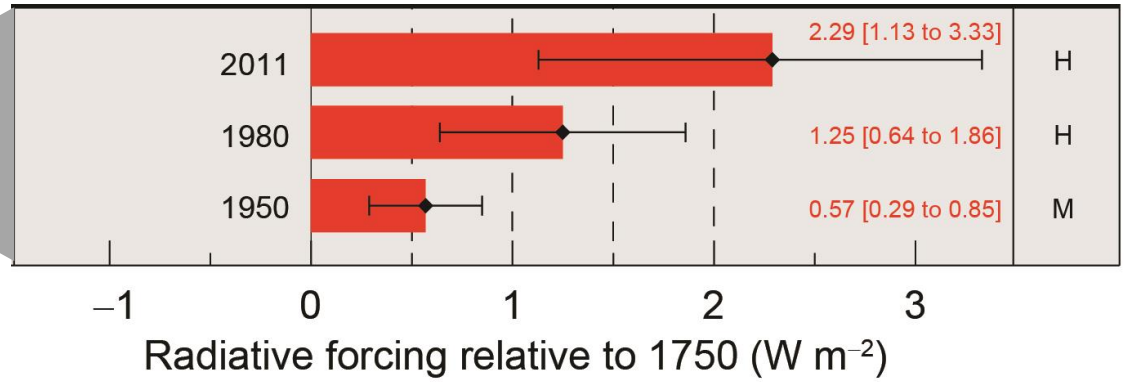
Since 1870, an amount of 515 [445 to 585] GtC was already emitted by 2011.

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	Emitted compound	Resulting atmospheric drivers	Radiative forcing by emissions and drivers	Level of confidence
Well-mixed greenhouse gases	CO <sub>2</sub>	CO <sub>2</sub>	1.68 [1.33 to 2.03]	VH
	CH <sub>4</sub>	CO <sub>2</sub> , H <sub>2</sub> O*, O <sub>3</sub> , CH <sub>4</sub>	0.97 [0.74 to 1.20]	H
	Halo-carbons	O <sub>3</sub> , CFCs, HCFCs	0.18 [0.01 to 0.35]	H
Atmospheric aerosols	N <sub>2</sub> O	N <sub>2</sub> O	0.17 [0.13 to 0.21]	VH
	CO	CO <sub>2</sub> , CH <sub>4</sub> , O <sub>3</sub>	0.23 [0.16 to 0.30]	M
	NMVOG	CO <sub>2</sub> , CH <sub>4</sub> , O <sub>3</sub>	0.10 [0.05 to 0.15]	M
	NO <sub>x</sub>	Nitrate, CH <sub>4</sub> , O <sub>3</sub>	-0.15 [-0.34 to 0.03]	M
	Aerosols and precursors (Mineral dust, Sulfate, Nitrate, Organic carbon, Black carbon, Cloud adjustments due to aerosols)	Mineral dust, Sulfate, Nitrate, Organic carbon, Black carbon, Cloud adjustments due to aerosols	-0.27 [-0.77 to 0.23]	H
Natural	Albedo change due to land use		-0.15 [-0.25 to -0.05]	M
	Changes in solar irradiance		0.05 [0.00 to 0.10]	M
	Total anthropogenic RF relative to 1750		2.29 [1.13 to 3.33]	H

Radiative forcing relative to 1750 (W m<sup>-2</sup>)

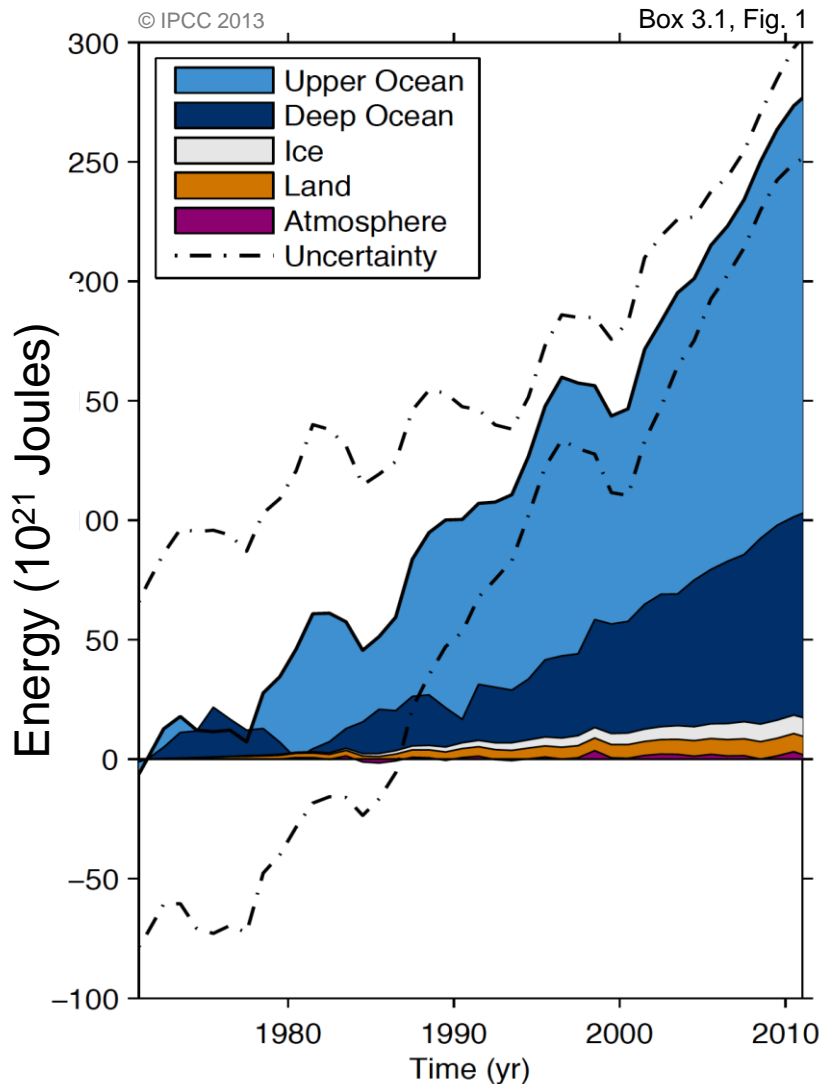


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Fig. SPM.5

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.





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*).

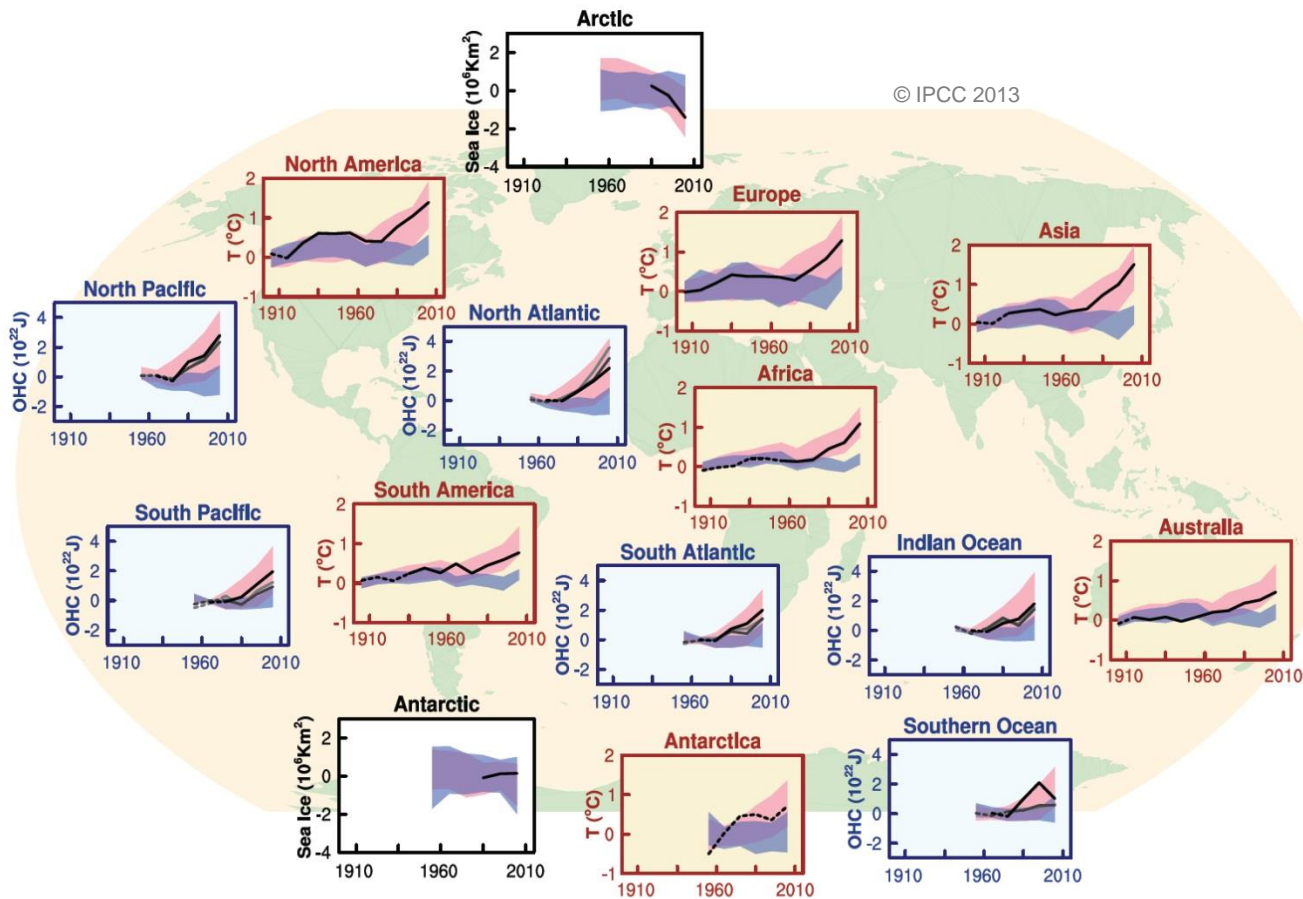


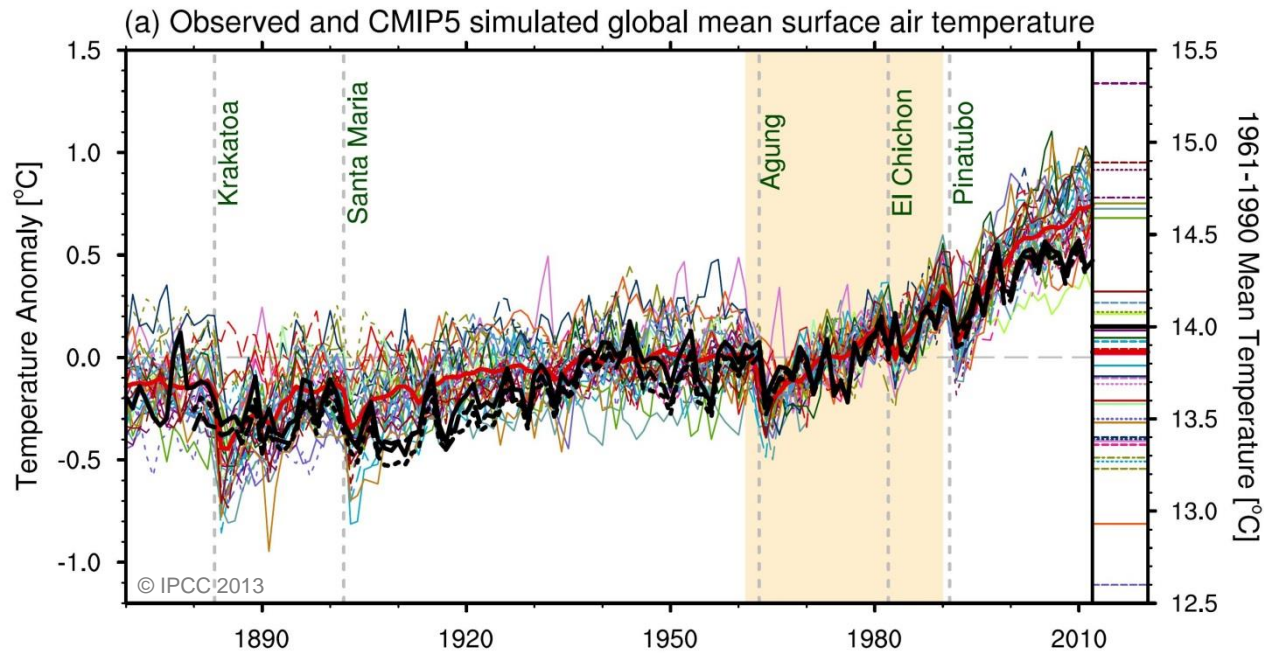
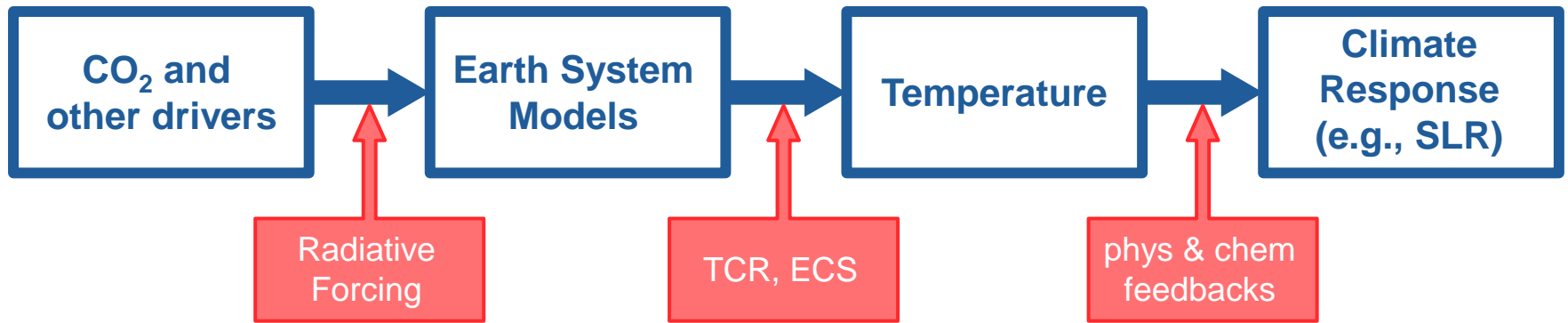
Fig. SPM.6

Human influence on the climate system is clear.

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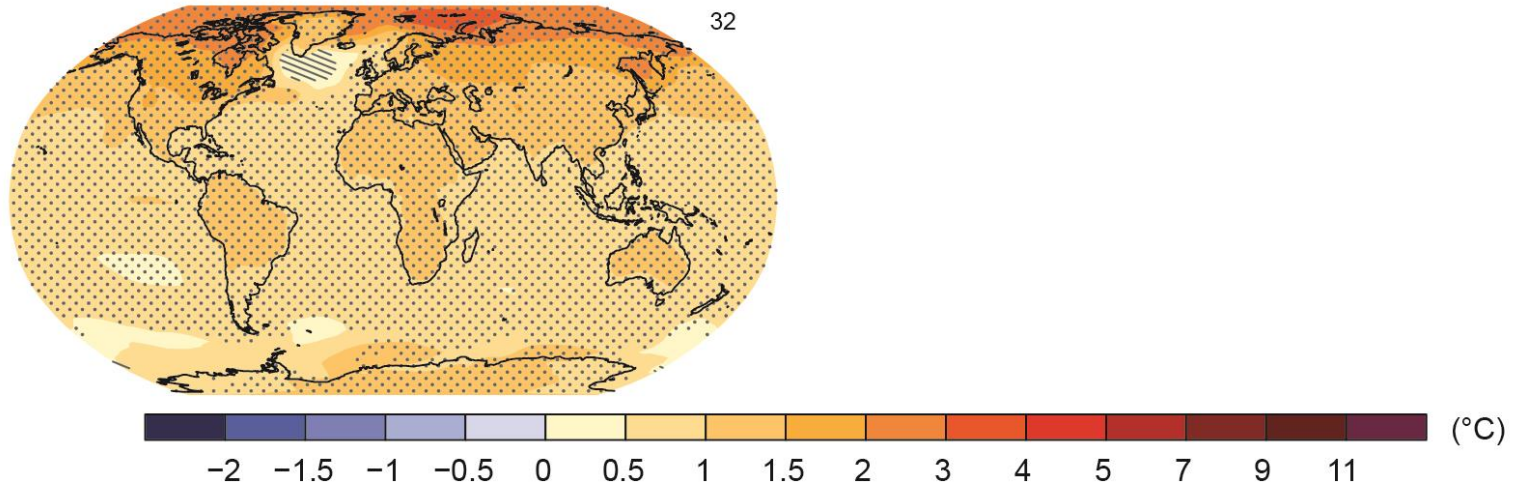


Climate models reproduce observed continental-scale surface temperature patterns and trends over many decades, [...]

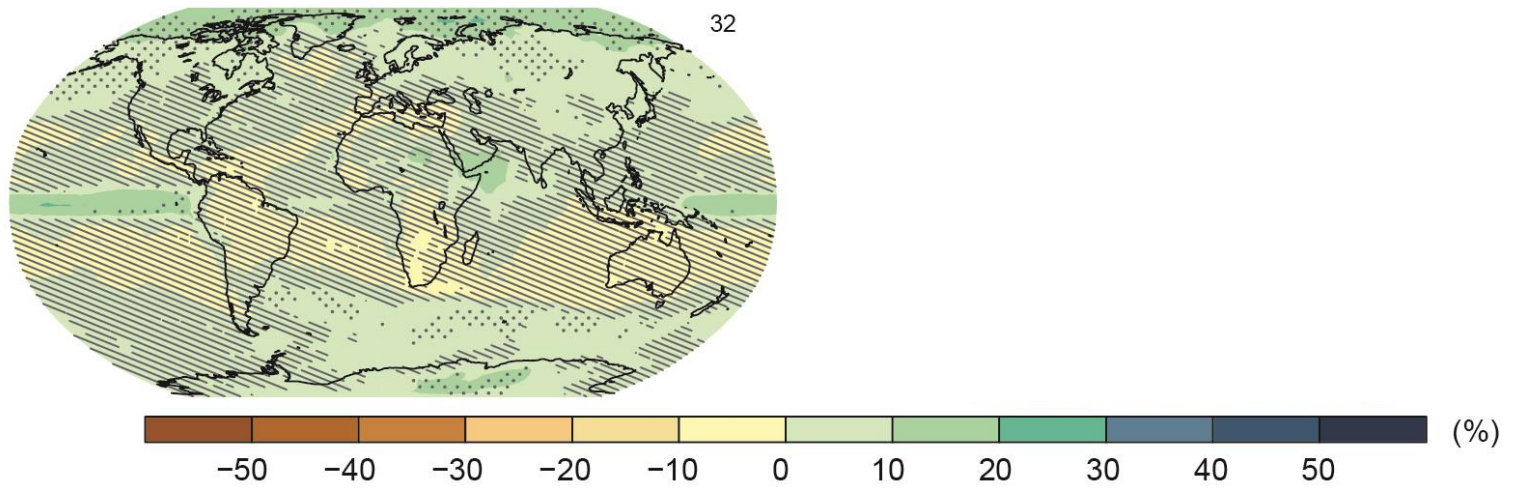
# RCP2.6

CO<sub>2eq</sub> = 475 ppm

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



Change in average precipitation (1986–2005 to 2081–2100)



Transient climate response to cumulative carbon emissions:

**TCRE = 0.8 to 2.5°C per 1000 GtC.**

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

Cumulative total emissions of CO<sub>2</sub> and global mean surface temperature response are approximately linearly related.

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

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

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