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Working Group I Contribution to the IPCC Fifth Assessment Report

Climate Change 2013: The Physical Science Basis

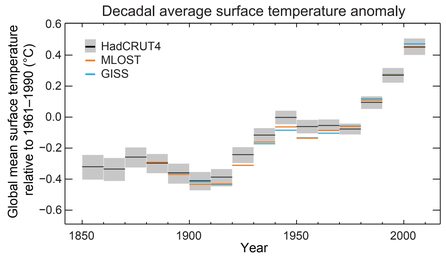
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

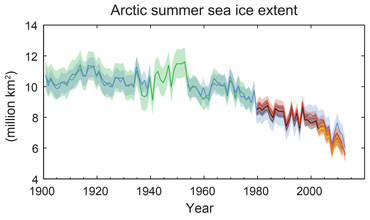
INTRODUCTION

The Working Group I contribution to the IPCC Fifth Assessment Report (WGI AR5) provides a comprehensive assessment of the physical science basis of climate change, drawing on the scientific literature accepted for publication up to 15 March 2013. The WGI AR5 Summary for Policymakers was approved at the Twelfth Session of Working Group I, held in Stockholm, Sweden, from 23 to 26 September, 2013. The session also accepted the Technical Summary and underlying scientific assessment contained in 14 chapters and related annexes. The narrative of the Summary for Policymakers follows the structure of the full report, and is supported by a series of overarching headline statements.

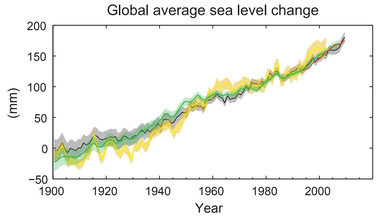
Warming of the climate system is unequivocal



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*).



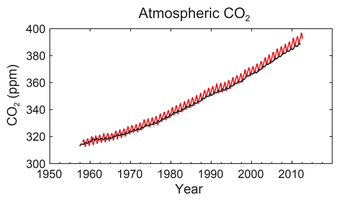
Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have contiued to decrease in extent (*high confidence*).



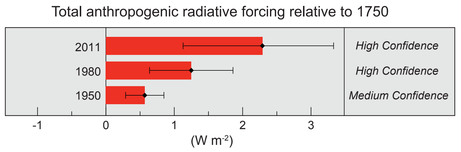
The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (*high confidence*). Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to 0.21] m.

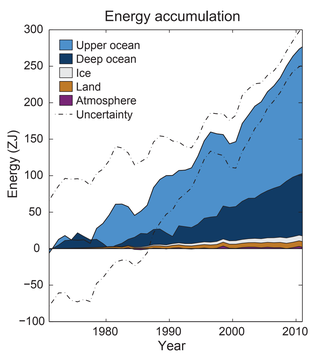
Adapted from Figures SPM.1 and 3

Total radiative forcing is positive and has led to uptake of energy by the climate system



The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions.





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*).

The largest contribution to total radiative forcing is caused by the increase in the atmospheric concentration of CO_2 since 1750.

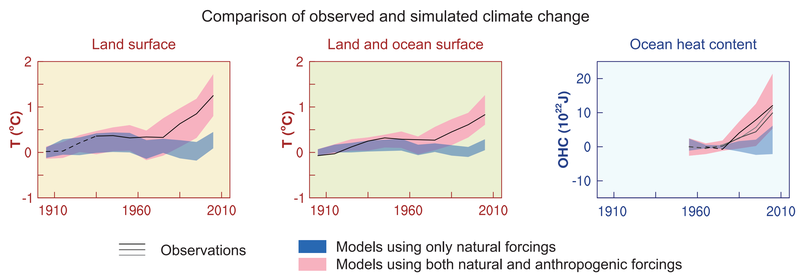
Adapted from Figures SPM.4 and 5, and Chapter 3 Box 3.1 Figure 1

REPORT STRUCTURE

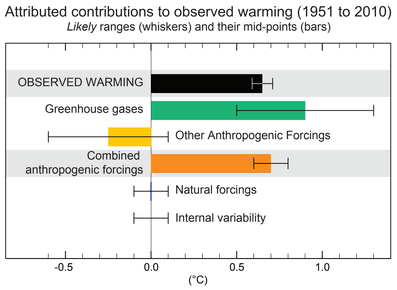
Introduction (Chapter 1)
Observations and Paleoclimate Information (Chapters 2, 3, 4, 5)
Process Understanding (Chapters 6, 7)
From Forcing to Attribution of Climate Change (Chapters 8, 9, 10)
Future Climate Change and Predictability (Chapters 11, 12)
Integration (Chapters 13, 14)
Annexes
Supplementary material

Human influence on the climate system is clear

Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system.



Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes.



It is *extremely likely* that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. The best estimate of the human-induced contribution to warming is similar to the observed warming over this period.

Over every continent except Antarctica (where observational uncertainties are large), anthropogenic forcings have *likely* made a substantial contribution to surface temperature increases since the mid-20th century.

Adapted from Figures SPM.6 and TS.10

IPCC, 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P. M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

www.climatechange2013.org

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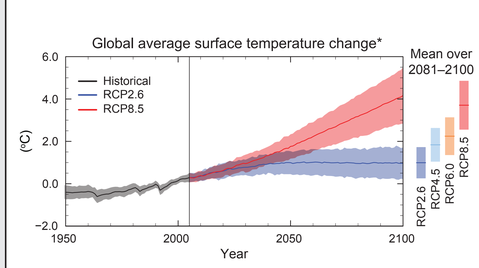
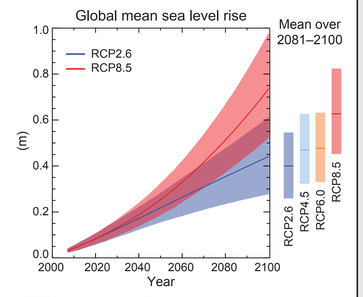
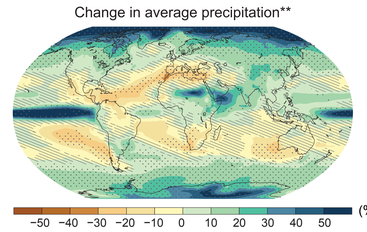
Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system



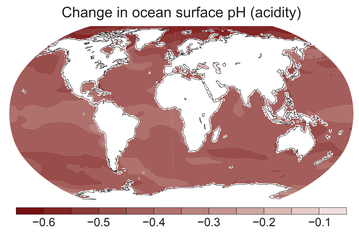
Global surface temperature change for the end of the 21st century is *likely* to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6. It is *likely* to exceed 2°C for RCP6.0 and RCP8.5, and *more likely than not* to exceed 2°C for RCP4.5.



Under all RCP scenarios, the rate of sea level rise will *very likely* exceed that observed during 1971 to 2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets.



Changes in the global water cycle in response to the warming over the 21st century will not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions.



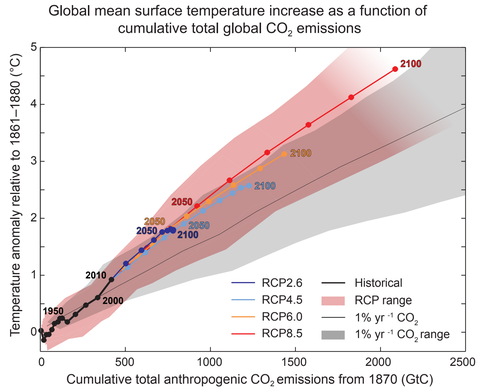
Climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO_2 in the atmosphere (*high confidence*). Further uptake of carbon by the ocean will increase ocean acidification.

* CMIP5 multi-model projected time-series shown here are relative to the base period of 1986–2005.

** CMIP5 multi-model projected maps shown here are for the late 21st century (2081–2100) relative to the base period, using RCP8.5. For precipitation, stippling indicates significant and large changes, and hatching indicates that changes are small relative to natural internal variability.

Adapted from Figures SPM.7, 8, and 9

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



Cumulative total emissions of CO_2 and global mean surface temperature response are approximately linearly related. Any given level of warming is associated with a range of cumulative CO_2 emissions, and therefore, e.g., higher emissions in earlier decades imply lower emissions later.

Most aspects of climate change will persist for many centuries even if emissions of CO_2 are stopped. This represents a substantial multi-century climate change commitment created by past, present and future emissions of CO_2.

Adapted from Figure SPM.10

Poster design and creation: Simon Allen