

**Selected statements from the Fourth
Assessment Report of the
Intergovernmental Panel on Climate
Change (IPCC-AR4)**

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**presented for approval by the
GREENCYCLES-II Summer School
Plenary,
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France**

WG I “The Physical Science Basis”
Section “Human and Natural Drivers of Climate Change”
Author: Pierre Friedlingstein

The understanding of anthropogenic warming and cooling influences on climate has improved since the TAR, leading to very high confidence⁷ that the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W m⁻² (see Figure SPM.2). {2.3., 6.5, 2.9}

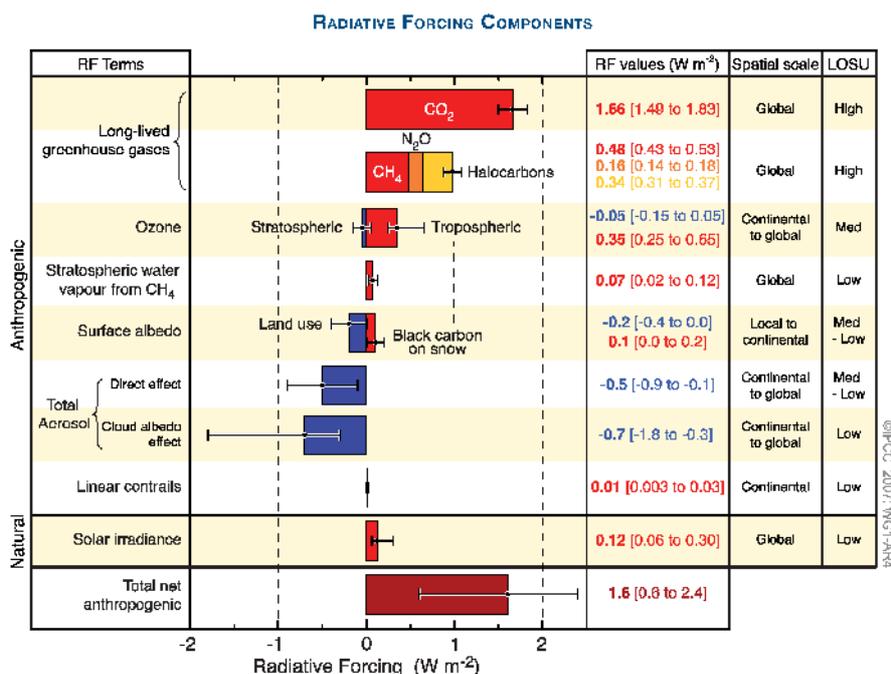


Figure SPM.2. Global average radiative forcing (RF) estimates and ranges in 2005 for anthropogenic carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). The net anthropogenic radiative forcing and its range are also shown. Those require summing asymmetric uncertainty estimates from the component terms, and cannot be obtained by simple addition. Additional forcing factors not included here are considered to have a very low LOSU. Volcanic aerosols contribute an additional natural forcing but are not included in this figure due to their episodic nature. The range for linear contrails does not include other possible effects of aviation on cloudiness. (2.9, Figure 2.20)

⁷ In this Summary for Policymakers the following levels of confidence have been used to express expert judgements on the correctness of the underlying science: very high confidence represents at least a 9 out of 10 chance of being correct; high confidence represents about an 8 out of 10 chance of being correct (see Box TS.1)

WG I “The Physical Science Basis”
Section “Direct Observations of Recent Climate Change”
Author: Stefan Rahmstorf

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 (see Figure SPM.3). {3.2, 4.2, 5.5}

CHANGES IN TEMPERATURE, SEA LEVEL AND NORTHERN HEMISPHERE SNOW COVER

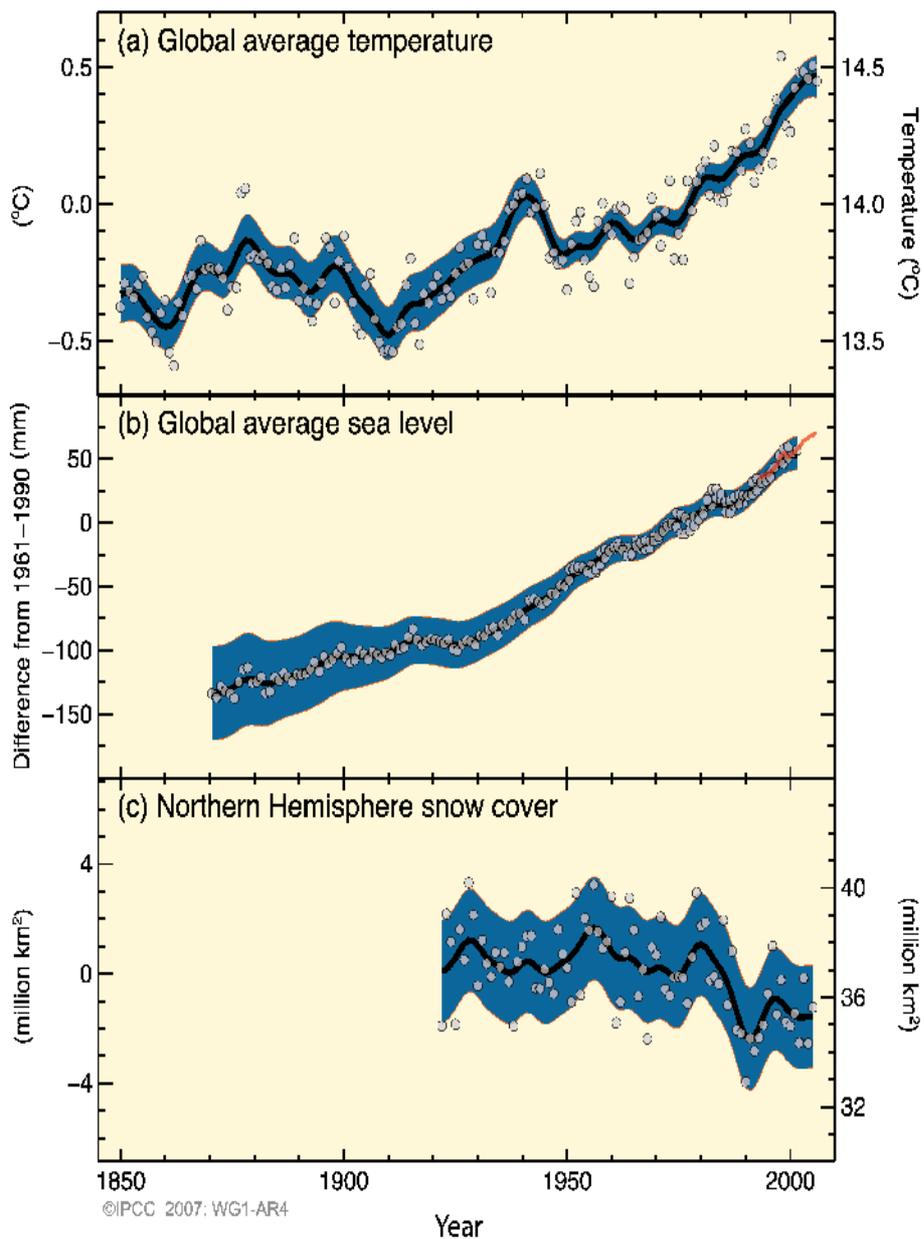


Figure SPM.3. Observed changes in (a) global average surface temperature, (b) global average sea level from tide gauge (blue) and satellite (red) data and (c) Northern Hemisphere snow cover for March–April. All changes are relative to corresponding averages for the period 1961–1990. Smoothed curves represent decadal average values while circles show yearly values. The shaded areas are the uncertainty intervals estimated from a comprehensive analysis of known uncertainties (a and b) and from the time series (c). {FAQ 3.1, Figure 1, Figure 4.2, Figure 5.13}

WG I “The Physical Science Basis”
Section “Understanding and Attributing Climate Change”
Author: Gavin Schmidt

Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.¹² This is an advance since the TAR’s conclusion that “most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations”. Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns (see Figure SPM.4 and Table SPM.2). {9.4, 9.5}

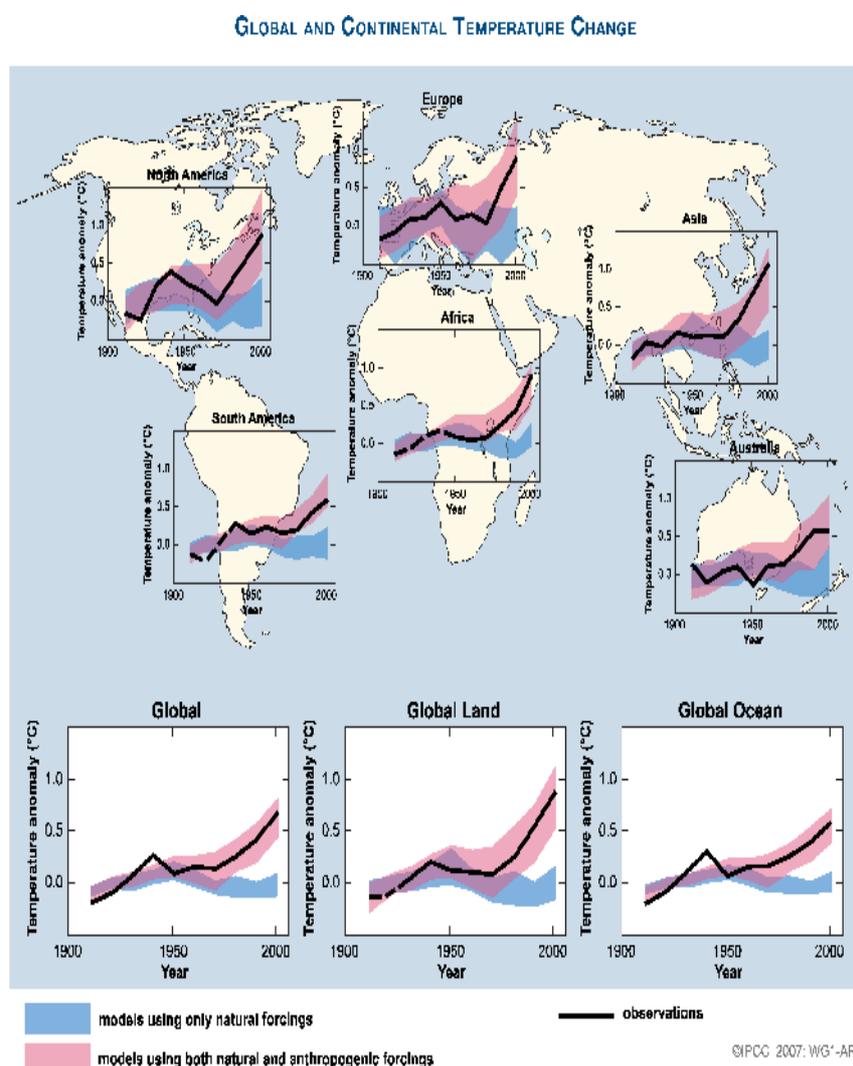


Figure SPM.4. Comparison of observed continental- and global-scale changes in surface temperature with results simulated by climate models using natural and anthropogenic forcings. Decadal averages of observations are shown for the period 1906 to 2005 (black line) plotted against the centre of the decade and relative to the corresponding average for 1901–1950. Lines are dashed where spatial coverage is less than 50%. Blue shaded bands show the 5–95% range for 19 simulations from five climate models using only the natural forcings due to solar activity and volcanoes. Red shaded bands show the 5–95% range for 58 simulations from 14 climate models using both natural and anthropogenic forcings. [ARQ 9.2, Figure 1]

12 Consideration of remaining uncertainty is based on current methodologies

WG II “Impacts, Adaptation and Vulnerability”**Section “Current knowledge of observed impacts of climate change on the natural and human environment”****Author: Santi Sabate**

Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.

With regard to changes in snow, ice and frozen ground (including permafrost),⁴ there is high confidence that natural systems are affected. Examples are:

- enlargement and increased numbers of glacial lakes [1.3];
- increasing ground instability in permafrost regions, and rock avalanches in mountain regions [1.3];
- changes in some Arctic and Antarctic ecosystems, including those in sea-ice biomes, and also predators high in the food chain [1.3, 4.4, 15.4].

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WG II “Impacts, Adaptation and Vulnerability”**Section “Current knowledge of observed impacts of climate change on the natural and human environment”****Author: Wolfgang Cramer**

Recent climate changes and climate variations are beginning to have effects on many other natural and human systems. However, based on the published literature, the impacts have not yet become established trends. Examples include:

- Settlements in mountain regions are at enhanced risk of glacier lake outburst floods caused by melting glaciers. Governmental institutions in some places have begun to respond by building dams and drainage works [1.3].
- In the Sahelian region of Africa, warmer and drier conditions have led to a reduced length of growing season with detrimental effects on crops. In southern Africa, longer dry seasons and more uncertain rainfall are prompting adaptation measures [1.3].
- Sea-level rise and human development are together contributing to losses of coastal wetlands and mangroves and increasing damage from coastal flooding in many areas [1.3].

4 See Working Group I Fourth Assessment

WG II “Impacts, Adaptation and Vulnerability”
Section “Current knowledge about future impacts”
Author: Andrew Friend

The following is a selection of key findings...

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Food, fibre and forest products

Crop productivity is projected to increase slightly at mid- to high latitudes for local mean temperature increases of up to 1-3°C depending on the crop, and then decrease beyond that in some regions. * D [5.4]

At lower latitudes, especially seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C), which would increase the risk of hunger. * D [5.4]

Globally, the potential for food production is projected to increase with increases in local average temperature over a range of 1-3°C, but above this it is projected to decrease. * D [5.4, 5.6]

WG II “Impacts, Adaptation and Vulnerability”
Section “Current knowledge about future impacts”
Author: Meike Vogt

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Polar Regions

In the Polar Regions, the main projected biophysical effects are reductions in thickness and extent of glaciers and ice sheets, and changes in natural ecosystems with detrimental effects on many organisms including migratory birds, mammals and higher predators. In the Arctic, additional impacts include reductions in the extent of sea ice and permafrost, increased coastal erosion, and an increase in the depth of permafrost seasonal thawing. ** D [15.3, 15.4, 15.2]

For human communities in the Arctic, impacts, particularly those resulting from changing snow and ice conditions, are projected to be mixed. Detrimental impacts would include those on infrastructure and traditional indigenous ways of life. ** D [15.4]
 Beneficial impacts would include reduced heating costs and more navigable northern sea routes. * D [15.4]

D: Further development of a conclusion in the TAR, N: New conclusion, not in the TAR

*** very high confidence, ** high confidence, * medium confidence

WG II “Impacts, Adaptation and Vulnerability”
Section “Current knowledge about responding to climate change”
Author: Kirsten Zickfeld

A wide array of adaptation options is available, but more extensive adaptation than is currently occurring is required to reduce vulnerability to future climate change. There are barriers, limits and costs, but these are not fully understood.

Synthesis Report
Section “Causes of Change”
Author: Stefan Rahmstorf

Advances since the TAR show that discernible human influences extend beyond average temperature to other aspects of climate. {2.4}

Human influences have: {2.4}

- *very likely* contributed to sea level rise during the latter half of the 20th century
- likely contributed to changes in wind patterns, affecting extra-tropical storm tracks and temperature patterns
- *likely* increased temperatures of extreme hot nights, cold nights and cold days
- *more likely than not* increased risk of heat waves, area affected by drought since the 1970s and frequency of heavy precipitation events.