

# Climate Change in Perspective

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Important core findings of climate research have been so well confirmed in recent decades that they are generally accepted as facts by climate researchers. These core findings include the following:

1. The atmospheric CO<sub>2</sub> concentration has risen strongly since about 1850, from 280 ppm (a value typical for warm periods during at least the past 700,000 years) to 380 ppm.
2. This rise is caused by humans and is primarily due to the burning of fossil fuels, with a smaller contribution due to deforestation.
3. CO<sub>2</sub> is a gas that affects climate by changing the earth's radiation budget: an increase in its concentration leads to a rise in near-surface temperature. If the concentration doubles, the resulting global mean warming will very likely be between 1.5 and 4.5°C (the most probable value being close to 3°C).
4. In the 20th century, global climate warmed by ~0.6°C. Temperatures in the past ten years have been the highest since instrumental records started in the 19th century and for at least several centuries before that (see Fig. 1).
5. Most of this warming is due to the rising concentration of CO<sub>2</sub> and other anthropogenic gases; a smaller part is due to natural causes, like fluctuations in solar activity.

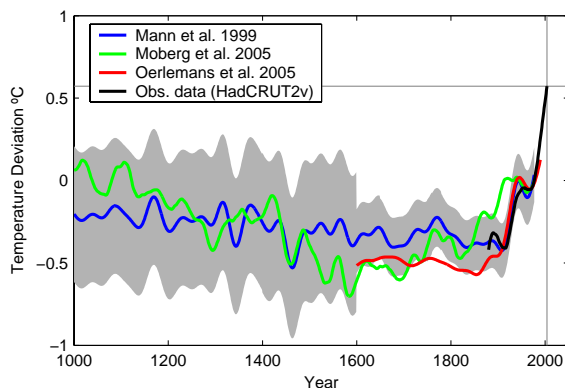


Fig. 1. Temperature in the Northern Hemisphere during the past millennium. Shown is the classic reconstruction of Mann et al. 99 (with its uncertainty band in grey, as shown in the 2001 IPCC report) as well as two new reconstructions including sediment data (green) and using glacier extensions (red). Black is the observations from weather stations up to 2004 (Hadley Centre). Curves are smoothed over two decades and show deviations relative to 1961-1990.

These findings are based on decades of research and thousands of studies. The extraordinary consensus reached is seen in the statements of many international and national professional bodies which have extensively and critically assessed the scientific evidence. In addition to the well-known reports of the IPCC, there are public statements of the National Scientific Academies of all G8 countries, the American Geophysical Union (AGU), the World Meteorological Organisation (WMO), the scientific Advisory Council on Global Change (WBGU) of the German government, and many others. These organisations have again and again come to the same key conclusions.

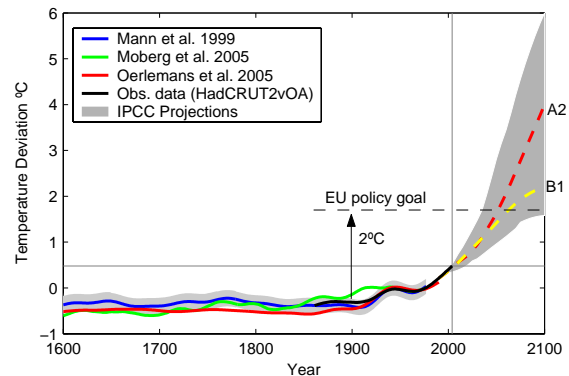


Fig. 2. IPCC projections for global mean temperature in the 21<sup>st</sup> Century. The grey band shows the full range of scenarios; red and yellow are two examples (B1 and A2). For comparison, temperatures for the past centuries are shown as in Fig. 1. Even the most optimistic future scenarios by far exceed the range of past natural variations, regardless of the remaining uncertainty about the latter. The EU 2°-target is also shown.

From points 1. – 3. follows that a further increase in CO<sub>2</sub> concentration must lead to a further rise in global mean temperature (Fig. 2). For a range of plausible assumptions about future emissions, this rise will be in the range of 1.4-5.8 °C (from 1990 to 2100). For comparison: the last major global warming was the end of the last great Ice Age (about 15,000 years ago); it involved a global warming of 4-7 °C over a time span of 5,000 years. Unchecked anthropogenic warming could reach a similar magnitude over a fraction of this time – and, of course, starting from an already warm climate.

Many risks are involved in such an unprecedented warming.

- **Sea level rise and loss of ice sheets.** Sea level is currently already increasing at 3 cm/decade. Future rise by 2100 will likely be less than one meter, but even if warming is stopped at 3 °C, sea level will probably keep rising by several meters in subsequent centuries in a delayed response. Coastal cities and low-lying islands are at risk.
- **Loss of ecosystems and species.** Global temperatures would reach a high never seen for millions of years, and the rise would be much too fast for species to adapt.
- **Risk of extreme events.** In a warmer climate, the risk of flooding events (like in Prague and Dresden 2002) will increase as warmer air can hold more water. Droughts and forest fires are likely to increase in some regions, as is currently occurring in the Mediterranean region. Hurricanes are expected to become more destructive (an increase in energy, not frequency, of hurricanes is suggested by both models and data).
- **Risk of food shortages.** While global agricultural production is not necessarily expected to decline in a warmer climate, many poorer and warmer countries could see reductions in yields due to water shortages and weather extremes.

These are only examples – the exact consequences of such a major change in climate are difficult to predict, and surprises are likely.