

Global warming continues...

Recent evidence of warming

- During the last northern hemisphere winter, parts of North America and Europe experienced unusually large snow falls and cool temperatures, leading to further publicity to the persistent, but unfounded, assertions that the Earth stopped warming in 1998.
- In fact, the last October-March period (chosen to encompass this 'cold' period) was the hottest seen in the 30 years of satellite data we have and the 130 years of surface data we have.
- The figure below shows how this recent six-month period compares to past October-March periods in the satellite and surface temperature data records. It also shows:

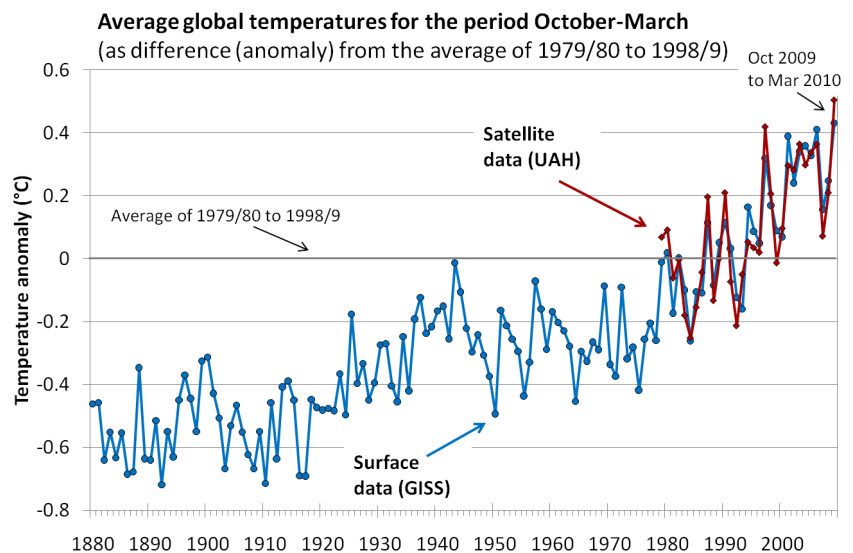
1. Global warming never 'stopped':

There is a clear continuing warming trend after 1998 that includes the Northern Hemisphere winter of 2009/10.

2. The warming trend of global surface temperatures is real:

The global surface temperature, which is calculated by averaging temperature readings from many measurement stations around the world, has been criticised for being unreliable. This is because individual stations can be affected by non-climate factors, such as the urban heat island effect or instrument problems. The global average can be affected by changes in the number of records and their locations over time.

- None of these potential problems affect the satellite data. However, the linear trends of both data sets, taken from when the satellite observations began, are virtually identical. Even the year-to-year variations match closely. This confirms that the surface warming is real and not due to data problems.



Global mean six-month (October-March) average temperatures from two data sets: (1) satellites (the Spencer-Christy lower atmospheric temperature dataset, in red, labelled "UAH", available at vortex.nsstc.uah.edu/data/msu/t2lt/uahncdc.lt53a), and (2) surface records (the NASA Goddard Institute for Space Studies dataset, in blue, labelled "GISS", available at data.giss.nasa.gov/gistemp/tabledata/GLB.Ts+dSST.txt). Temperature averages are shown as anomalies relative to the first twenty years of satellite observations (i.e., 1979/80-1998/99).

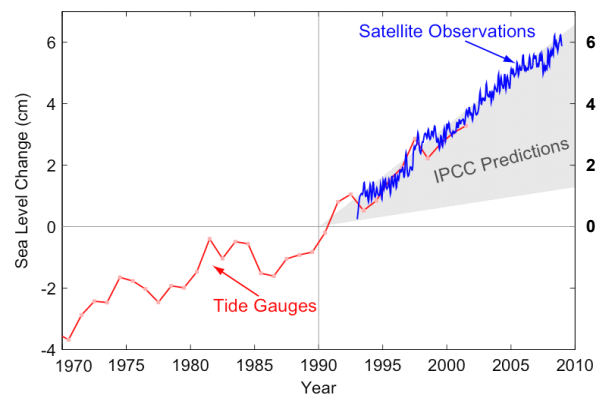
Warming of the climate system as evidence of climate change

- Warming of the global climate system is one of the important strands of evidence for human-induced climate change.
- Solar radiation heats the earth and this heat is absorbed by greenhouse gases, warming the atmosphere. The additional carbon dioxide and other greenhouse gases emitted by human activities into the atmosphere are trapping more heat than in pre-industrial times.
- This extra heat is absorbed by different parts of the climate system – especially the atmosphere, the oceans and by melting ice. The resulting warming is accompanied by other changes, such as in rainfall, sea level and atmospheric and ocean circulation.

- Warming of the atmosphere is important because it affects the biosphere and many environmental impacts such as fire and snow. Instrumental records link current climate with climates of the past, measured using a whole range of environmental proxies. However, the most compelling evidence of a changing climate is the large amounts of heat being stored in the oceans.

- The global climate system has warmed significantly over the last century and continues to warm. Evidence of this warming is found in:

- Increases in global mean temperature in the lower atmosphere and at the surface
- Increases in the heat content of the global oceans
- Decreases in the extent of sea ice in the Arctic
- Reductions in the extent of glaciers around the globe (including in the Antarctic)
- Increases in global sea level due to the heating oceans and melting ice (see right).



Observed and predicted sea level change relative to the average of 1970–2010. The increase in sea level is caused from both melting of ice sheets and glaciers and from the expansion of the oceans as they heat up. (From The Copenhagen Diagnosis, 2009)

- Factors other than changing concentrations of greenhouse gases can also change climate – changes in solar intensity, changes in the Earth’s orbit, changes in atmospheric aerosols from volcanoes and pollution, and changes in the amount sunlight reflected away from the Earth can also alter climate.
- However, none of these additional mechanisms are contributing to the current warming – under natural conditions the Earth would probably be cooling slightly at present. Greenhouse gases being emitted by humans into the atmosphere provide the only plausible scientific explanation for the observed changes.

Warming trends and climate variations

- Shorter-term climate variations are occurring on top of the gradual warming of the climate system, meaning that observed changes are not smooth. Nor would we expect them to be.
- There are normally large weather and climate variations from year to year and between regions. These variations are due to natural climate ‘modes’ such as El Niño.
- Therefore, the clearest evidence of global climate change is found by considering the whole globe and variations from one decade to the next.
- Recent cold weather and heavy snowfalls in Western Europe and the eastern United States in winter 2009/10 are not evidence for or against climate change. These variations were due to El Niño and another climate mode called the Arctic Oscillation, which cause warmer temperatures in the tropics and the Arctic, but cooler temperatures in the mid-latitudes of the Northern Hemisphere.

Further Information

[The Copenhagen Diagnosis, 2009: Updating the World on the Latest Climate Science](#). The University of New South Wales Climate Change Research Centre (CCRC).

[Climate Change 2007: Fourth Assessment Report of the Intergovernmental Panel on Climate Change \(IPCC\)](#).