



Climate change myths



Prof. John Mitchell OBE FRS, Chief Scientist at the Met Office explores some of the common myths about climate change.

The Met Office recognises that climate change is a complex subject. There are genuine areas of uncertainty and scientific controversy. There are also a number of misunderstandings and myths which are recycled, often by non-climate scientists, and portrayed as scientific fact.

Recent coverage has questioned the influence of humans on the climate. While the arguments used might have been regarded as genuine areas of sceptical enquiry 20 years ago, further observed warming and advances in climate science render these out of touch.

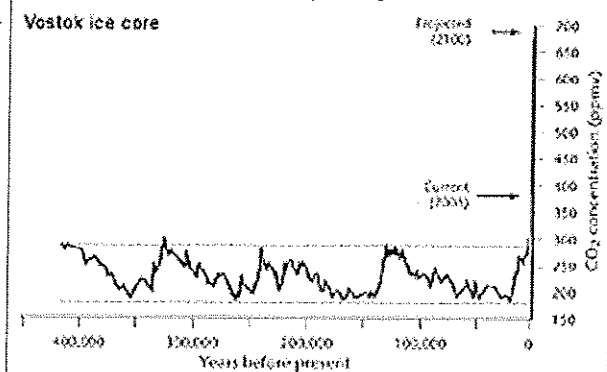
Myth 1 - Ice core records show that changes in temperature drive changes in carbon dioxide, and it is not carbon dioxide that is driving the current warming

Only the first part of this statement is true. Over the several hundred thousand years covered by the ice core record, the temperature changes were primarily driven by changes in the Earth's orbit around the sun. Over this period, changes in temperature did drive changes in carbon dioxide (CO₂). Concentrations of CO₂ are now much higher and increasing much faster than at any time in at least the last 600,000 years. This should be a warning that what is happening now is very different to what happened in the past.

In fact, over the last 100 years CO₂ concentrations have increased by 30% due mainly to human-induced emissions from fossil fuels. Because CO₂ is a greenhouse gas, the increased concentrations have contributed to the recent warming and probably most of the warming over the last 50 years.

The bottom line is that temperature and CO₂ concentrations are linked. In recent ice ages, natural changes in the climate (due to orbit changes for example) led to cooling of the climate system. This caused a fall in CO₂ concentrations which weakened the greenhouse effect and amplified the cooling. Now the link between temperature and CO₂ is working in the opposite direction. Human-induced increases in CO₂ is enhancing the greenhouse effect and amplifying the recent warming.

Levels of atmospheric CO₂ are higher than at any time in the last 430,000 years



Click on the image for a larger view

Myth 2 - Solar activity is the main driver of climate change

There are many factors which may contribute to climate change. For example, over the last million years most of the long-term changes in climate were probably due to small but well understood changes in the Earth's orbit around the Sun. Over much of the last 1,000 years most of the variability can probably be explained by cooling due to major volcanic eruptions and changes in solar heating.

However, the situation in the 20th century is more complicated. There is some evidence that increases in solar heating may have led to some warming early in the 20th century, but direct satellite measurements show no appreciable change in solar heating over the last three decades. Three major volcanic eruptions in 1963, 1982 and 1991 have led to short periods of cooling. Throughout the century CO₂ increased steadily and has been shown to be responsible for most of the warming in the second half of the century.

The final piece of the jigsaw is that as well as producing CO₂, burning fossil fuels also produces small particles called aerosols which cool the climate by reflecting

Temperature change, 1850-2000

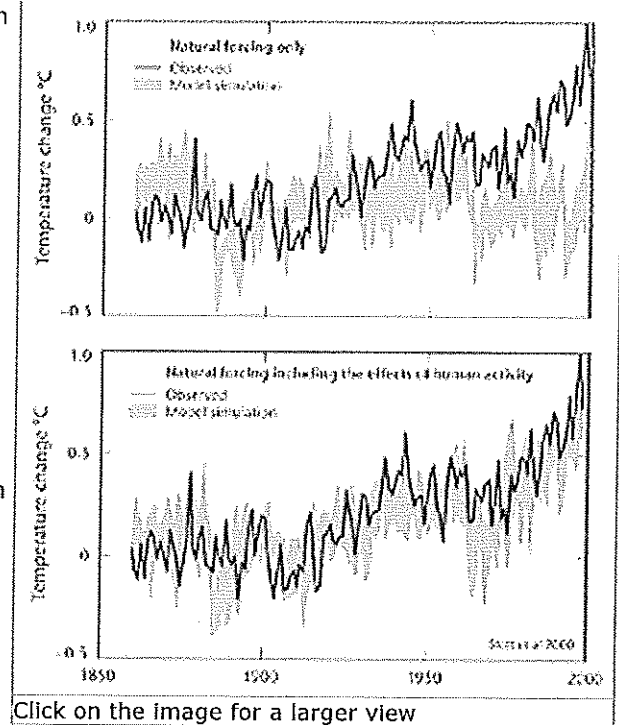
sunlight back into space. These have increased steadily in concentration over the 20th century, which has probably offset some of the warming we have seen. Only when all of these factors are included do we get a satisfactory explanation of the magnitude and patterns of climate change over the last century.

The bottom line is that changes in solar activity do affect global temperatures. However, what research also shows is that increased greenhouse gas concentrations have a much greater effect than changes in the Sun's energy over the last 50 years.

Myth 3 - There is less warming in the upper atmosphere than at the surface which disproves human-induced warming

We expect greater warming in the upper atmosphere than at the surface in the tropics, but the reverse is true at high latitudes. This expectation holds whether the cause of warming is due to greenhouse gases or changes in the Sun's output. Until recently, measurements of the temperature changes in the tropics in recent decades did not appear to show greater warming aloft than at the surface. It has now been shown that allowing for uncertainties in the observations, the theoretical and modelling results can be reconciled with the observations.

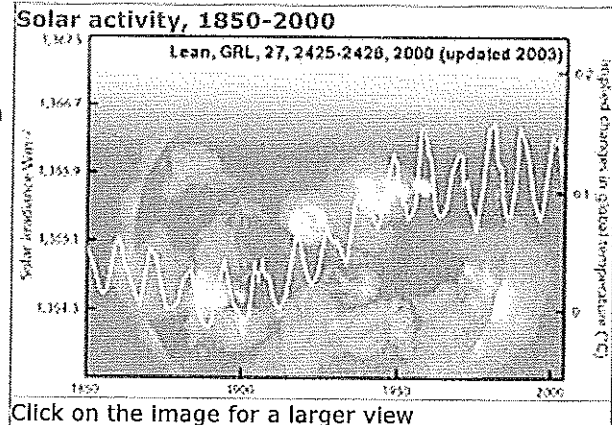
The bottom line is that the range of available information is now consistent with increased warming through the troposphere (the lowest region of the atmosphere).



Myth 4 - The intensity of cosmic rays changes climate

A recent experiment has apparently shown that gamma radiation can form ions (electrically charged particles) in the atmosphere. Under certain circumstances, these can subsequently form ultra-fine particles (or aerosols), which could conceivably act as cloud condensation nuclei (CCN) and therefore form clouds. However, the mechanism by which cosmic rays might affect climate is as yet purely speculative and unquantified. While it has long been known that radiation could form ions and, in theory, ultimately lead to cloud formation, the importance of this process compared to all the other major sources of particles and CCN has not been proven. Indeed, there is no evidence that the flux of cosmic rays has decreased over the last 30 years.

The bottom line is, even if cosmic rays have a detectable effect on climate (and this remains unproven), measured solar activity over the last few decades has not significantly changed and cannot explain the continued warming trend. In contrast, increases in CO2 are well measured and its warming effect is well quantified. It offers the most plausible explanation of most of the recent warming and future increases.



Myth 5 - Climate models are too complex and uncertain to provide useful projections of climate change

There have been major advances in the development and use of models over the last 20 years. The models are based mainly on the laws of physics. There are also empirical techniques which use, for example, studies of detailed processes involved in cloud formation. The most advanced computer models also include detailed coupling of the circulations of atmosphere and oceans, along with detailed descriptions of the feedbacks between all components of the climate system including the cryosphere and biosphere. Climate models have been used to reproduce the main features of the current climate, the temperature changes over the last hundred years and the main features of the Holocene (6,000 years ago) and Last Glacial Maximum (21,000) years ago.

The bottom line is that current models enable us to attribute the causes of past climate change and predict the main features of the future climate with a high degree of confidence. We now need to provide more regional detail and more complete analysis of extreme events.

Met Office work on climate change

The Met Office Hadley Centre was opened in the early 1990s and is a world-leading climate centre. It has over 150 world-renowned climate experts who draw from the expertise of the supercomputer modellers at the Met Office.

It is the UK's official centre for climate change research — partly funded by Defra (the Department for Environment Food and Rural Affairs) and MOD — which provides in-depth information and advice to the Government on climate change issues.

It undertakes studies of the global climate using similar, though more extensive, models of the atmosphere used for the prediction of weather conditions.

It informs the work of the Intergovernmental Panel on Climate Change (IPCC) and was the leading UK contributor to the Fourth Assessment Review published in February 2007. It assembled much of the scientific basis of the Stern Review on the Economics of Climate Change (pub. October 2006). Its research also informs the UK Climate Impacts Programme on how climate change will impact at regional and national levels in the UK.

It advises businesses and governments on the science of climate change and strategies for mitigation and adaptation.

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