

Climate change is all over the news, from the politics of the Copenhagen summit to the University of East Anglia (UEA) emails and the latest criticisms of the Intergovernmental Panel on Climate Change (IPCC). Climate sceptics and some parts of the press have seized on this as evidence that the whole edifice of climate science is crumbling, but this briefing sets out to explain that this could not be further from the truth. The main uncertainties over climate change are not about whether or not it is happening, but about how fast it is happening and how bad it will get.

Don't the University of East Anglia's leaked emails question the basic evidence for global warming?

It has been alleged that one of the UEA emails shows that scientists manipulated the data when comparing the time series of temperature measurements with a proxy record created from tree ring data. UEA denies any trickery: the method they used deals with a change in the relationship between tree growth and temperature since the mid-twentieth century, partly driven by atmospheric pollution.

The UEA temperature series is one of three global temperature records, each created independently. The two temperature series from the US, from NASA and the National Oceanic and Atmospheric Administration (NOAA), show very [similar temperature patterns](#). There is a particularly marked warming trend over the last three decades in all three data series. Most climate scientists continue to agree that the evidence for global warming is unequivocal and there is very high confidence that human activity is responsible for much of this warming.

Further concern has arisen over temperature data from rural China, used in a study of the role of urbanisation in warming. It seems that this research may not be reliable, but this is only one study among many that demonstrate global warming over the last three decades.

But they tried to suppress the raw climate data – surely they must be hiding something?

UEA has commissioned an independent inquiry that will look at the handling of requests for raw data, and it appears that UEA may not have complied with the requirements of the Freedom of Information (FoI) Act. Even had the requests been handled correctly, UEA did not own much of the data and would not have been able to release it without permission – in the same way that we can't release data that we have purchased from other organisations. The Met Office has started to [release the raw climate data](#) and is seeking permission to release the rest of it.

Isn't the IPCC's evidence for a changing climate looking a bit weak too?

There are reports of two errors in the IPCC's 2007 report. The report said that Himalayan glaciers will disappear by 2035 – this is not true, as glaciers melt very slowly, and this section of the report was not based on peer-reviewed literature. Questions have also been raised as to why claims about rainforest die-back were not referenced to more reliable sources. The IPCC also reported that one study had shown that the

increasing cost of natural disasters was partly related to climate change: an early, unpublished version of the paper said this but the final version did not.

A huge amount of other, more important, evidence of the impact climate change including rising sea levels, reduced Arctic ice cover, and receding glaciers was also covered by the report. This evidence still stands. And the Himalayan glaciers are still melting – just not as fast as the IPCC claimed.

Isn't there a case for easing off on cuts in carbon emissions?

The atmospheric concentration of carbon dioxide (CO₂) is now about 388 parts per million (ppm), up from a pre-industrial level of about 280 ppm. The longest measured record, at [Mauna Loa](#), shows a very strong rising trend over the last 50 years. There is no doubt that CO₂ is an important greenhouse gas, and that rising levels of CO₂ will lead to global warming. The climate system is complicated, with many feedbacks between the atmosphere, oceans and the land. Even if CO₂ emissions stopped now, the global temperature would increase until the end of the century because of the CO₂ levels already in the atmosphere. To avoid dangerous climate change, CO₂ and other greenhouse gas emissions need to be reduced as quickly as possible.

Climate change happened long before we started burning fossil fuels – isn't it all natural variability?

Climate is naturally variable, and there have been many cycles of warming and cooling caused by natural changes such as solar radiation and changes in the earth's orbit. This natural variability continues, but the very rapid rate of warming over recent decades reflects the very rapid increase in CO₂ levels from fossil fuels. This cannot be accounted for by natural cycles alone: the greenhouse gas impact is additional to natural variation.

Couldn't we look a bit stupid trying to adapt to something that lots of people don't believe is happening?

Most of the adaptation measures we are proposing are flexible, and usually improve our adaptation to current as well as future climate. For example, reducing water use saves energy, improves security of supply for everyone, and protects the natural environment. Allowing for climate change in flood defences gives additional protection in the early years. Climate change should always be one of many factors we take into account when planning our activities: we should select options that allow us to deal with a range of future conditions, based on a relevant planning horizon. Our work on Thames Estuary 2100 is a good example of contingency planning, where alternative pathways are mapped out to address a range of possible scales and speeds of future sea level rise.

What should the Environment Agency learn from all of this?

We know that we deal with Freedom of Information requests properly and current events underline the importance of our continuing to do so.

We certainly need to be careful about attributing individual events like floods or droughts to climate change unless we have clear evidence, ideally published in peer-reviewed academic papers. It's tempting – and the press often tempt us – to respond to a big flood by saying it's a sign of climate change, but we really don't have proof. Certainly these are the sort of events we would expect to see more of under a changing climate, but we cannot attribute any one directly to it. Our climate is naturally variable, and it is not possible to use individual events to prove or disprove climate change – so the Cumbrian floods don't prove climate change, in the same way that the worst snow for 20 years doesn't disprove global warming either.