

'Clear' human impact on climate

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Weather balloons have provided climate data since the 1950s

A scientific report commissioned by the US government has concluded there is "clear evidence" of climate change caused by human activities.

The report, from the federal Climate Change Science Program, said trends seen over the last 50 years "cannot be explained by natural processes alone".

It found that temperatures have increased in the lower atmosphere as well as at the Earth's surface.

However, scientists involved in the report say better data is badly needed.

Observations down the years have suggested that the troposphere, the lower atmosphere, is not warming up, despite evidence that temperatures at the Earth's surface are rising.

This goes against generally accepted tenets of atmospheric physics, and has been used by "climate sceptics" as proof that there is no real warming.

The new report, *Temperature Trends in the Lower Atmosphere*, re-analyses the atmospheric data and concludes that tropospheric

temperatures are rising.

“ We do now have overlap between what is happening and what we believe ought to be happening ”

Peter Thorne, UK Met Office

This means, it says, that the impact of human activities upon the global climate are clear.

"The observed patterns of change over the past 50 years cannot be explained by natural processes alone, nor by the effect of short-lived atmospheric constituents (such as aerosols and tropospheric ozone) alone," it says.

Holes in the data

But there are some big uncertainties which still need resolving.

Globally, the report concludes, tropospheric temperatures have risen by 0.10 and 0.20C per decade since 1979, when satellite data became generally available.

The wide gap between the two figures means, says the report, that "...it is not clear whether the troposphere has warmed more or less than the surface".

Peter Thorne, of the UK Meteorological Office, who contributed to the report, ascribes this uncertainty to poor data.

"Basically, we've not been observing the atmosphere with climate in mind," he told the BBC News website.

"We're looking for very small signals in data that are very noisy. From one day to the next, the temperature can change by 10C, but we're looking for a signal in the order of 0.1C per decade."

“ The interpretation that's been given is different from what the data says ”

Fred Singer, Sepp

The report shows up a particular discrepancy concerning the tropics, where it concludes that temperatures are rising by between 0.02 and 0.19C per decade, a big margin of error.

Additionally, the majority of the available datasets show more warming at the surface than in the troposphere, whereas most models predict the opposite.

For Fred Singer, of the Science and Environmental Policy Project, a prominent climate sceptic, this suggests that the report's support for the

concept of human-induced climate change is spin rather than substance.

"The basic data in the report is quite OK," he said, "but the interpretation that's been given is different from what the data says.

"In particular, [the authors] suppress the major result of the report; that data do not agree with models."

'No inconsistency'

Measuring tropospheric temperatures is far from a simple business.

Satellites sense the "average" temperature of the air between themselves and the Earth, largely blind to what is happening at different altitudes.

To compound matters, instruments on board satellites degrade over time, orbits subtly drift, and calibration between different satellites may be poor.



The study was financed from US federal climate research funds

Weather balloons (or radiosondes) take real-time measurements as they ascend, but scientists can never assess instruments afterwards; they are "fire-and-forget" equipment.

Correcting for all these potential sources of error is a sensitive and time-consuming process.

The report makes clear recommendations for the kind of infrastructure needed to produce higher-quality data and resolve remaining uncertainties.

Key recommendations include:

- establishing reference sites for radiosonde measurements which would increase consistency between datasets
- making sure the operating periods of satellites overlap so instruments can be cross-calibrated
- observing factors such as wind, clouds, and humidity in the troposphere to make sure they are consistent with temperature data

Such observations could produce an unambiguous picture of tropospheric warming, removing discrepancies over the scientific picture

and providing better data which can be used to improve computer models.

"I would be reticent to say the report provides a clear answer," said Peter Thorne, "but I would say it provides a clear road-map.

"But we do now have overlap between what is happening and what we believe ought to be happening."

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