

10 May 2013 Last updated at 15:39 GMT

Carbon dioxide passes symbolic mark



Key measurements are made on top of the Mauna Loa volcano

Carbon dioxide levels in the atmosphere have broken through a symbolic mark.

Daily measurements of CO₂ at a US government agency lab on Hawaii have topped 400 parts per million for the first time.

The station, which sits on the Mauna Loa volcano, feeds its numbers into a continuous record of the concentration of the gas stretching back to 1958.

The last time CO₂ was regularly above 400ppm was three to five million years ago - before modern humans existed.

Scientists say the climate back then was also considerably warmer than it is today.

Carbon dioxide is regarded as the most important of the manmade greenhouse gases blamed for raising the temperature on the planet over recent decades.

Human sources come principally from the burning of fossil fuels such as coal, oil and gas.

[Continue reading the main story](#)

“Start Quote

In eight to nine years we will probably have seen the last CO₂ reading under 400ppm”

James Butler Noaa

The usual trend seen at the volcano is for the CO₂ concentration to rise in winter months and then to fall back as the northern hemisphere growing season kicks in. Forests and other vegetation pull some of the gas out of the atmosphere.

This means the number can be expected to decline by a few ppm below 400 in the coming weeks. But the long-term trend is upwards.

Carbon by proxy

James Butler is responsible for the Earth System Research Laboratory, a facility on Mauna Loa belonging to the National Oceanic and Atmospheric Administration (Noaa). Its daily average CO2 concentration figure on Thursday was 400.03.

Dr Butler told BBC News: "Carbon dioxide has some variability on an hourly, daily and weekly basis, so we are not comfortable calling a single number - the lowest we will go is on a daily average, which has happened in this case.

"Mauna Loa and the South Pole observatory are iconic sites as they have been taking CO2 measurements in real time since 1958. Last year, for the first time, all Arctic sites reached 400ppm.

"This is the first time the daily average has passed 400ppm at Mauna Loa."

[Continue reading the main story](#)



Analysis [David Shukman](#) Science editor, BBC News

Near the summit of the Mauna Loa volcano, the carbon dioxide monitors stand amid one of the world's remotest huddles of scientific instruments. To reach them you have to leave the steamy Hawaii coast and climb through barren lava-fields.

At the top, above 11,000ft, the air is thin and the sun piercing. During my visit, I watched rain clouds boiling in the valleys below me. Charles David Keeling chose this otherworldly spot because the air up here is neither industrial nor pristine; it is "well-mixed" which means it can serve as a useful guide to changes in the atmosphere.

Despite their global significance, the devices he installed back in 1958 do not look impressive. But he battled bureaucratic objections to fund them and his legacy is the longest continuous record of a gas, linked to much of global warming, that just keeps rising.

- [Read more from David](#)

The long-term measurements at Mauna Loa were started by a Scripps Institution of Oceanography scientist called Charles Keeling.

In 1958, he found the concentration at the top of the volcano to be around 315ppm (that is 315 molecules of CO2 for every one million molecules in the air). Every year since then, the "Keeling Curve", as it has become known, has squiggled resolutely higher.

Scripps still operates equipment alongside Noaa on the mountain peak.

Its readings have been pushing 400ppm in recent days, and on Thursday recorded a daily average of 399.73.

But Noaa senior scientist Pieter Tans said: "Our measurements (Noaa) are in Coordinated Universal Time, while the Keeling measurements are in local Hawaii time. If you shift the Keeling definition of a day to the same as ours then we do agree almost completely on the measurements." By this definition, the Keeling team's Thursday number would be 400.08ppm.

And Dr Butler added: "Probably next year, or the year after that, the average yearly reading will

pass 400ppm.

"A couple of years after that, the South Pole will have readings of 400ppm, and in eight to nine years we will probably have seen the last CO2 reading under 400ppm."

To determine CO2 levels before the introduction of modern stations, scientists must use so-called proxy measurements.

These include studying the bubbles of ancient air trapped in Antarctic ice.

One of these can be used to describe CO2 levels over the past 800,000 years. It suggests that CO2 held steady over this longer period at between 200ppm and 300ppm.

British atmospheric physicist Prof Joanna Haigh commented: "In itself, the value 400ppm of CO2 has no particular significance for the physics of the climate system: concentration levels have been in the 300s for so long and now we've passed the 400 mark. However, this does give us the chance to mark the ongoing increase in CO2 concentration and talk about why it's a problem for the climate."