# Climate change: The state of our atmosphere

*Last seen three million years ago, the amount of the Earth's warming will get greater, even if it falls again.*

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The "Statement on the State of the Global Climate in 2019" has been issued by the World Meteorological Office. It stated 2019 ended with a global average temperature of 1.1 degree Celsius above estimated pre-industrial levels, second only to the record set in 2016, a year influenced by a strong El Nino event.

In 2018, greenhouse gas ratios reached new highs with carbon dioxide (CO2) at 407 parts per million (ppm). Preliminary data indicates that greenhouse gas concentrations continued to increase in 2019.

### ****The usefulness of greenhouse gases****

This needs some context to understand. The reason we can live on this planet is because greenhouse gases keep it warmer than an atmosphere without them would provide. However, if the amount of the most effective heat-trapping greenhouse gases is increased too much, we will simply overheat, in an out-of-control manner.

Since the dawn of humanity, we have never seen such a high concentration of CO2 in the atmosphere. At the start of the industrial revolution, it was at 275ppm. In prehistory, there have been higher levels.

### ****Historic warming****

A paper published by Yale University in 2017 lays out the following points: The last time the atmosphere contained 400ppm of CO2 was about three million years ago, the mid-Pliocene, recently enough for the planet to be not radically different than it is today.

Back then, temperatures were 2 to 3C (3.6 to 5.4F) above pre-industrial temperatures. The Arctic was more than 10C hotter, and sea levels were 15-25 metres higher.

Homo habilis (aka "handy man"), the first species in the Homo line and probably the first stone-tool users, got a taste of this climate as he arrived on the scene 2.8 million years ago (Homo sapiens didn't show up until 400,000 years ago at the earliest).

### ****Record reliability****

There's a lot of debate about both temperatures and CO2 levels from millions of years ago. But the evidence is much firmer for the last 800,000 years, when ice cores show that CO2 concentrations stayed between 180 and 290 ppm. There have been [eight glacial cycles](http://www.nature.com/nature/journal/v429/n6992/full/nature02599.html" \t "_blank) over these past 800,000 years, mostly driven by regular and understood [wobbles in the Earth's orbit](https://skepticalscience.com/heading-into-new-little-ice-age.htm" \t "_blank). This is the benchmark against which scientists usually note the unprecedented modern rise of CO2.

Beyond just the concentration of greenhouse gases, the rate of increase in concentration appears to be unprecedented. Dana Royer, a climatologist at Wesleyan University said during the end-Triassic extinction, 200 million years ago, [CO2 values jumped](http://www.annualreviews.org/eprint/s4mGxirtMfIWRNpgk5dc/full/10.1146/annurev-earth-100815-024150) from about 1,300ppm to 3,500ppm. That took somewhere between 1,000 to 20,000 years and was caused by massive volcanic eruptions in what is now the central Atlantic.

### ****Current risk****

Today, we could conceivably change our atmosphere by thousands of parts per million in just 200 years. There is nothing anywhere near that in the ice core records. Though 400 seems a big number now, CO2 concentrations could easily pass 500ppm in the coming decades, and even reach 2,000 by 2250 if emissions are not brought under control.

The Intergovernmental Panel on Climate Change (IPCC) [report from 2013](http://www.ipcc.ch/report/ar5/wg1/" \t "_blank) shows the projected outcome depending on our actions:

In the most pessimistic scenario, where the population booms, technology stagnates, and emissions keep rising, the atmosphere gets to a startling 2,000 ppm by about 2250. That gives us an atmosphere last seen during the Jurassic when dinosaurs roamed, and causes an apocalyptic temperature rise of perhaps 9C (16F).

In the most optimistic scenario, where emissions peak now (2010-2020) and start to decline, with humans actually removing carbon from the air by 2070, the atmosphere dips back down below 400ppm somewhere between 2100 and 2200.

Even assuming a scenario of zero emissions from very soon, getting back to pre-industrial levels of 280ppm is "sort of a 10,000-year proposition", said Ralph Keeling, director of the Scripps Institution of Oceanography's CO2 programme in San Diego. It was Ralph's father who set up the Mauna Loa CO2well-positioned measuring site in Hawaii in 1958. At that time, the concentration of CO2was 316ppm.

"If humanity wishes to preserve a planet similar to that on which civilisation developed and to which life on Earth is adapted ... CO2 will need to be reduced ... to at most 350 ppm," Columbia University climate guru James Hansen [has said](http://400.350.org/).

We sailed past that target in about 1990, and it will take a gargantuan effort to turn back the clock.

SOURCE: AL JAZEERA NEWS