



What is climate change?

The Earth's climate has changed on many timescales in response to natural factors. On long timescales, such as tens of thousands of years, we see the Earth move in and out of ice ages. At the other extreme, El Ninos come and go every few years, temporarily raising the Earth's temperature. So, what aspects of our climate are changing and what is causing these changes?

Since we emerged from the last ice age around 11,000 years ago, the Earth's climate has remained relatively stable, with global temperatures averaging at about 14°C. However, in the last century our climate has started to change rapidly. This isn't thought to be just a temporary blip in the system; the evidence points to a long-term change in our climate which is happening at an unusual rate. But how can we tell if these changes are natural or whether they are down to us?

There are many factors that can cause a warming of our climate; for example, more energy from the sun, large natural events such as El Nino or an increased greenhouse effect. Scientists have ruled out the sun and natural variations in our climate as the major causes of the recent warming. There is overwhelming evidence that most of this warming we've seen is due to increased amounts of greenhouse gases in the atmosphere. Greenhouse gases, such as water vapour, carbon dioxide and methane, occur naturally in the atmosphere. But human activities have directly increased the amount of carbon dioxide, methane and some other greenhouse gases. These increases can be through the burning of fossil fuels such as oil and coal, and changes in land use such as chopping down forests for cattle grazing.

Carbon dioxide and methane are both important greenhouse gases which have the greatest effect on our changing climate. Methane has a stronger greenhouse effect, but there is less of it and it only remains in the atmosphere for about a decade. Carbon dioxide on the other hand is much more abundant in the atmosphere and lasts for about 100 years or more, having a greater cumulative affect on our climate. The amount of carbon dioxide in our atmosphere has increased by 38% since the industrial revolution and because it stays for such a long time in our atmosphere, as we emit more it continues to build up.

The world has warmed by three-quarters of a degree in the last century. On top of this we have seen changes in extremes of weather events, such as heatwaves and heavy rainfall. There is a natural carbon cycle in our climate. Carbon dioxide enters the atmosphere from a variety of sources, from the oceans, land and vegetation, from animals breathing or volcanoes erupting. They are *sources* of carbon dioxide. This in turn is absorbed by things like trees and plants, especially as they grow, by rocks and by the oceans. They are *sinks* of carbon dioxide. This cycle has been delicately balanced for thousands of years. However, the increases in the level of carbon dioxide in the atmosphere can not only be explained by these natural phenomena.

The current changes are very unusual and can not be explained simply as part of any natural cycle, such as El Nino and La Nina, which cause the warming and cooling of the tropical Pacific Ocean, which affects world temperature. Natural cycles can lead to periods with little or no warming and other periods with rapid warming. However, what is important is to look at the longer term trends in temperature, which are rising, and which scientists believe is almost certainly caused by human activity.

When studying climate change, scientists draw their evidence from many sources. Are humans contributing to the warming we are observing? Or could it be natural causes and changes to the climate? Scientists, such as those at the Met Office Hadley Centre, are continuing to look at all the possible effects, both man-made and natural. However, it is widely understood that our emissions of greenhouse gases are causing changes to our climate. For more information visit our climate change pages on our website.