# Five climate change science misconceptions debunked

September 16 2019, by Mark Maslin

Credit: AI-generated image (disclaimer)

The science of climate change is more than 150 years old and it is probably the most tested area of modern science. However the energy industry, political lobbyists and others have spent the last 30 years sowing doubt about the science where none really exists. The latest estimate is that the world's five largest publicly-owned oil and gas

companies spend about US$200m each year on lobbying to control, delay or block binding climate-motivated policy.

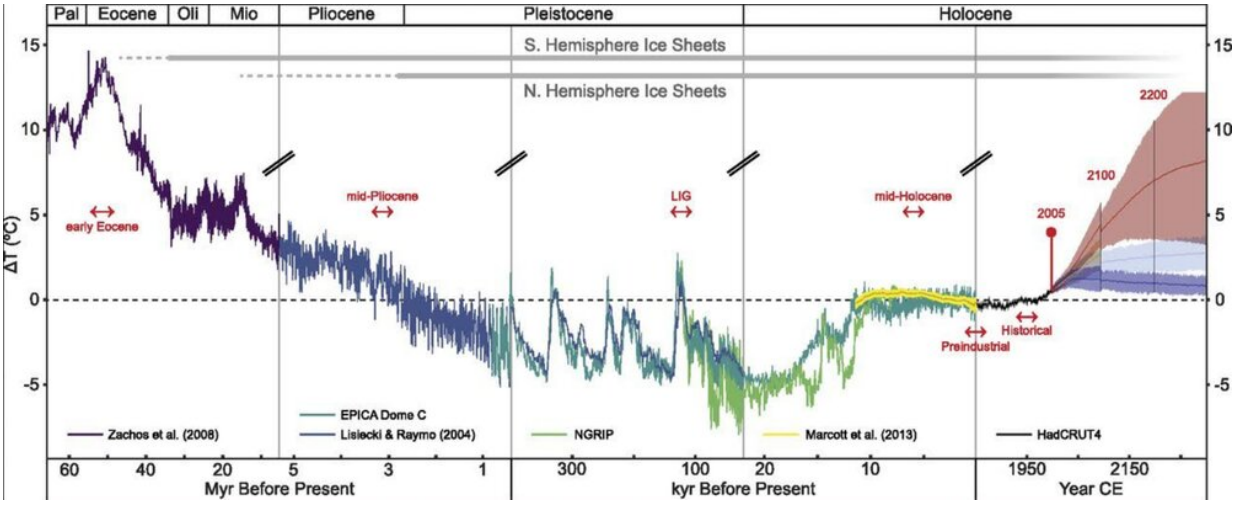
This organized and orchestrated climate change science denial has contributed to the lack of progress in reducing global green house gas (GHG) emissions—to the point that we are facing a global climate emergency. And when climate change deniers use certain myths—at best fake news and at worse straight lies—to undermine the science of climate change, ordinary people can find it hard to see through the fog. Here are five commonly used myths and the real science that debunks them.

## 1. Climate change is just part of the natural cycle

The climate of the Earth has always changed, but the study of palaeoclimatology or "past climates" shows us that the changes in the last 150 years – since the start of the industrial revolution—have been exceptional and cannot be natural. Modelling results suggest that future predicted warming could be unprecedented compared to the previous 5m years.

The "natural changes" argument is supplemented with the story that the Earth's climate is just recovering from the cooler temperatures of the Little Ice Age (1300-1850AD) and that temperatures today are really the same as the Medieval Warm Period (900–1300AD). The problem is that both the Little Ice Age and the Medieval Warming period were not global but regional changes in climate affecting north-west Europe, eastern America, Greenland and Iceland.

A study using 700 climate records showed that, over the last 2,000 years, the only time the climate all around the World has changed at the same time and in the same direction has been in the last 150 years, when over 98% of the surface of the planet has warmed.



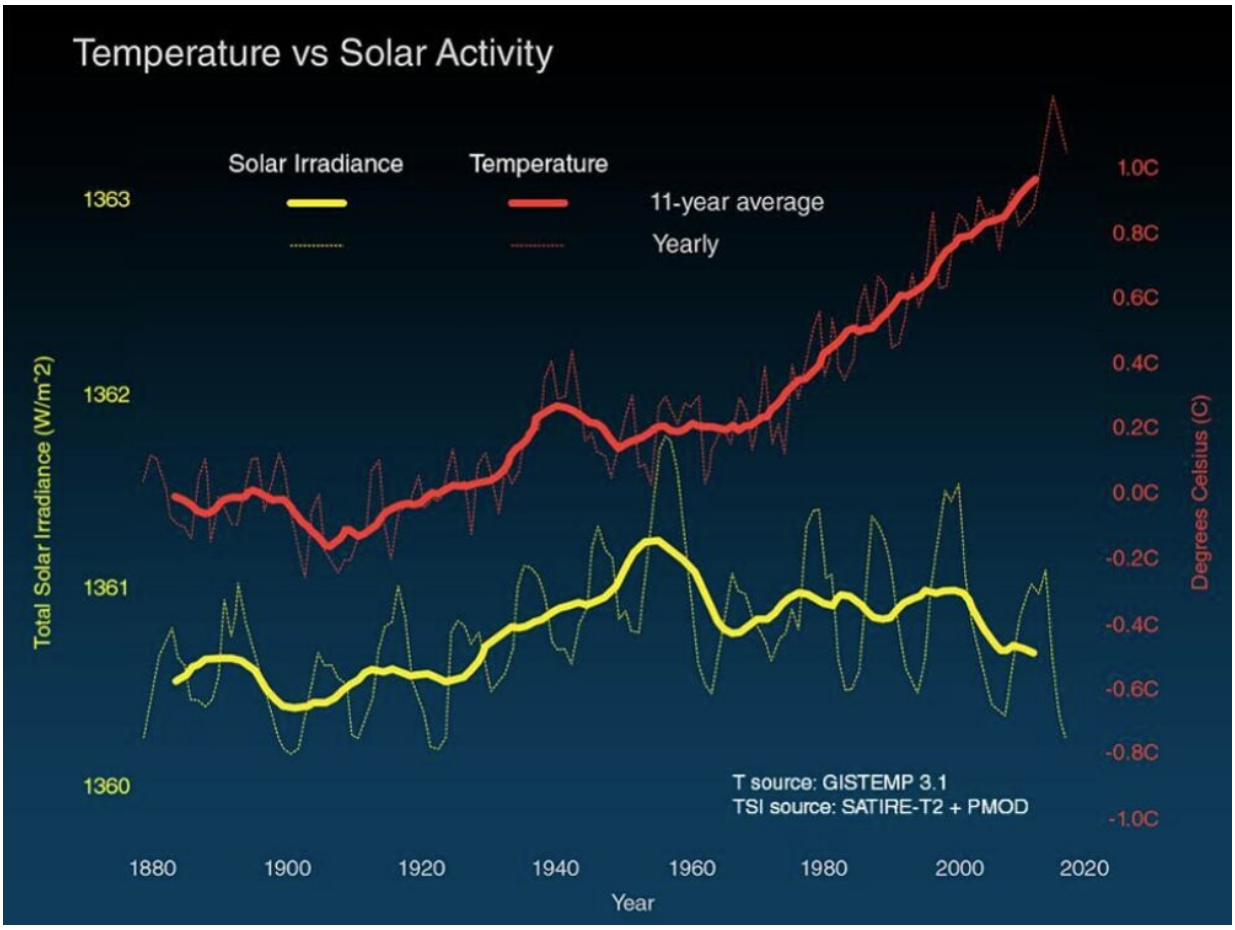

Global temperatures for the last 65m years and possible future global warming depending on the amount of greenhouse gases we emit. Credit: Burke et al (2018)

## 2. Changes are due to sunspots/galactic cosmic rays

Sunspots are storms on the sun's surface that come with intense magnetic activity and can be accompanied by solar flares. These sunspots do have the power to modify the climate on Earth. But scientists using sensors on satellites have been recording the amount of the sun's energy hitting Earth since 1978 and there has been no upward trend. So they cannot be the cause of the recent global warming.

Galactic cosmic rays (GCRs) are high-energy radiation that originates outside our solar system and may even be from distant galaxies. It has been suggested that they may help to seed or "make" clouds. So reduced GCRs hitting the Earth would mean fewer clouds, which would reflect less sunlight back into space and so cause Earth to warm.

But there are two problems with this idea. First, the scientific evidence shows that GCRs are not very effective at seeding clouds. And second, over the last 50 years, the amount of GCRs have actually increased, hitting record levels in recent years. If this idea were correct, GCRs should be cooling the Earth, which they aren't.



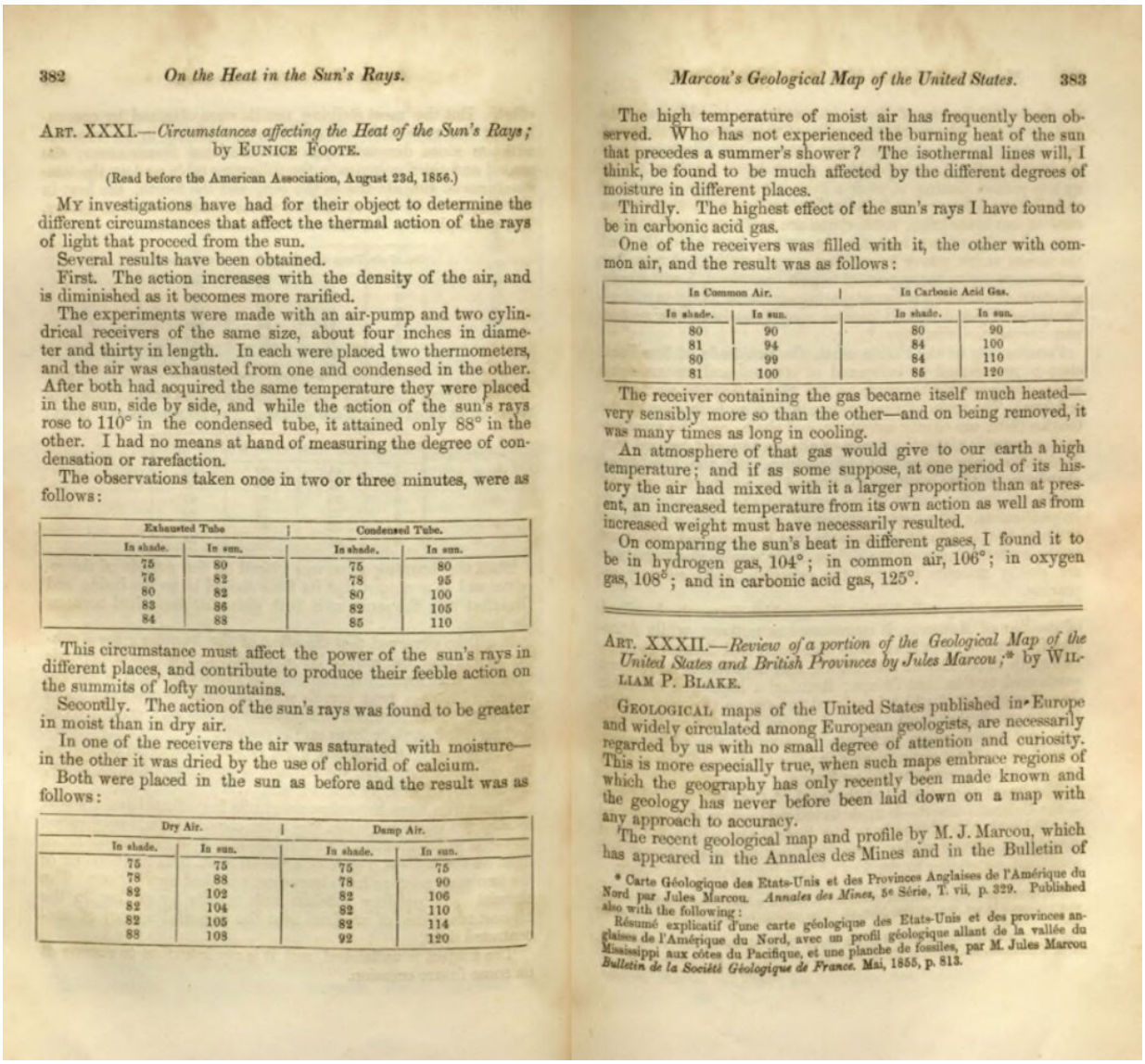

A comparison of global surface temperature changes (red line) and the sun's energy received by the Earth (yellow line) in watts (units of energy) per square metre since 1880. Credit: NASA, CC BY

### 3. $CO_2$ is a small part of the atmosphere—it can't have a large

**heating affect**

This is an attempt to play a classic common-sense card but is completely wrong. In 1856, American scientist Eunice Newton Foote conducted an experiment with an air pump, two glass cylinders and four thermometers. It showed that a cylinder containing carbon dioxide and placed in the sun trapped more heat and stayed warmer longer than a cylinder with normal air. Scientists have repeated these experiments in the laboratory and in the atmosphere, demonstrating again and again the greenhouse effect of carbon dioxide.

As for the "common sense" scale argument that a very small part of something can't have much of an effect on it, it only takes 0.1 grams of cyanide to kill an adult, which is about 0.0001% of your body weight. Compare this with carbon dioxide, which currently makes up 0.04% of the atmosphere and is a strong greenhouse gas. Meanwhile, nitrogen makes up 78% of the atmosphere and yet is highly unreactive.



382 *On the Heat in the Sun's Rays.*

ART. XXXI.—*Circumstances affecting the Heat of the Sun's Rays;* by EUNICE FOOTE.

(Read before the American Association, August 23d, 1856.)

MY investigations have had for their object to determine the different circumstances that affect the thermal action of the rays of light that proceed from the sun.

Several results have been obtained.

First. The action increases with the density of the air, and is diminished as it becomes more rarified.

The experiments were made with an air-pump and two cylindrical receivers of the same size, about four inches in diameter and thirty in length. In each were placed two thermometers, and the air was exhausted from one and condensed in the other. After both had acquired the same temperature they were placed in the sun, side by side, and while the action of the sun's rays rose to 110° in the condensed tube, it attained only 88° in the other. I had no means at hand of measuring the degree of condensation or rarefaction.

The observations taken once in two or three minutes, were as follows:

| Exhausted Tube | | Condensed Tube. | |
|---|---|---|---|
| In shade. | In sun. | In shade. | In sun. |
| 75 | 80 | 75 | 80 |
| 76 | 82 | 78 | 95 |
| 80 | 82 | 80 | 100 |
| 83 | 86 | 82 | 105 |
| 84 | 88 | 85 | 110 |

This circumstance must affect the power of the sun's rays in different places, and contribute to produce their feeble action on the summits of lofty mountains.

Secondly. The action of the sun's rays was found to be greater in moist than in dry air.

In one of the receivers the air was saturated with moisture—in the other it was dried by the use of chlorid of calcium.

Both were placed in the sun as before and the result was as follows:

| Dry Air. | | Damp Air. | |
|---|---|---|---|
| In shade. | In sun. | In shade. | In sun. |
| 75 | 75 | 75 | 75 |
| 78 | 88 | 78 | 90 |
| 82 | 102 | 82 | 106 |
| 82 | 104 | 82 | 110 |
| 82 | 105 | 82 | 114 |
| 88 | 108 | 92 | 120 |

*Marcou's Geological Map of the United States.* 383

The high temperature of moist air has frequently been observed. Who has not experienced the burning heat of the sun that precedes a summer's shower? The isothermal lines will, I think, be found to be much affected by the different degrees of moisture in different places.

Thirdly. The highest effect of the sun's rays I have found to be in carbonic acid gas.

One of the receivers was filled with it, the other with common air, and the result was as follows:

| In Common Air. | | In Carbonic Acid Gas. | |
|---|---|---|---|
| In shade. | In sun. | In shade. | In sun. |
| 80 | 90 | 80 | 90 |
| 81 | 94 | 84 | 100 |
| 80 | 99 | 84 | 110 |
| 81 | 100 | 85 | 120 |

The receiver containing the gas became itself much heated—very sensibly more so than the other—and on being removed, it was many times as long in cooling.

An atmosphere of that gas would give to our earth a high temperature; and if as some suppose, at one period of its history the air had mixed with it a larger proportion than at present, an increased temperature from its own action as well as from increased weight must have necessarily resulted.

On comparing the sun's heat in different gases, I found it to be in hydrogen gas, 104°; in common air, 106°; in oxygen gas, 108°; and in carbonic acid gas, 125°.

ART. XXXII.—*Review of a portion of the Geological Map of the United States and British Provinces by Jules Marcou;** by WILLIAM P. BLAKE.

GEOLOGICAL maps of the United States published in Europe and widely circulated among European geologists, are necessarily regarded by us with no small degree of attention and curiosity. This is more especially true, when such maps embrace regions of which the geography has only recently been made known and the geology has never before been laid down on a map with any approach to accuracy.

The recent geological map and profile by M. J. Marcou, which has appeared in the Annales des Mines and in the Bulletin of

* Carte Géologique des Etats-Unis et des Provinces Anglaises de l'Amérique du Nord par Jules Marcou. *Annales des Mines*, 5e Série, T. vii, p. 329. Published also with the following:

Résumé explicatif d'une carte géologique des Etats-Unis et des provinces anglaises de l'Amérique du Nord, avec un profil géologique allant de la vallée du Mississippi aux côtes du Pacifique, et une planche de fossiles, par M. Jules Marcou *Bulletin de la Société Géologique de France.* Mai, 1855, p. 813.

Eunice Newton Foote's paper, "Circumstances Affecting the Heat of the Sun's Rays." Credit: American Journal of Science, 1857

## 4. Scientists manipulate all data sets to show a warming trend

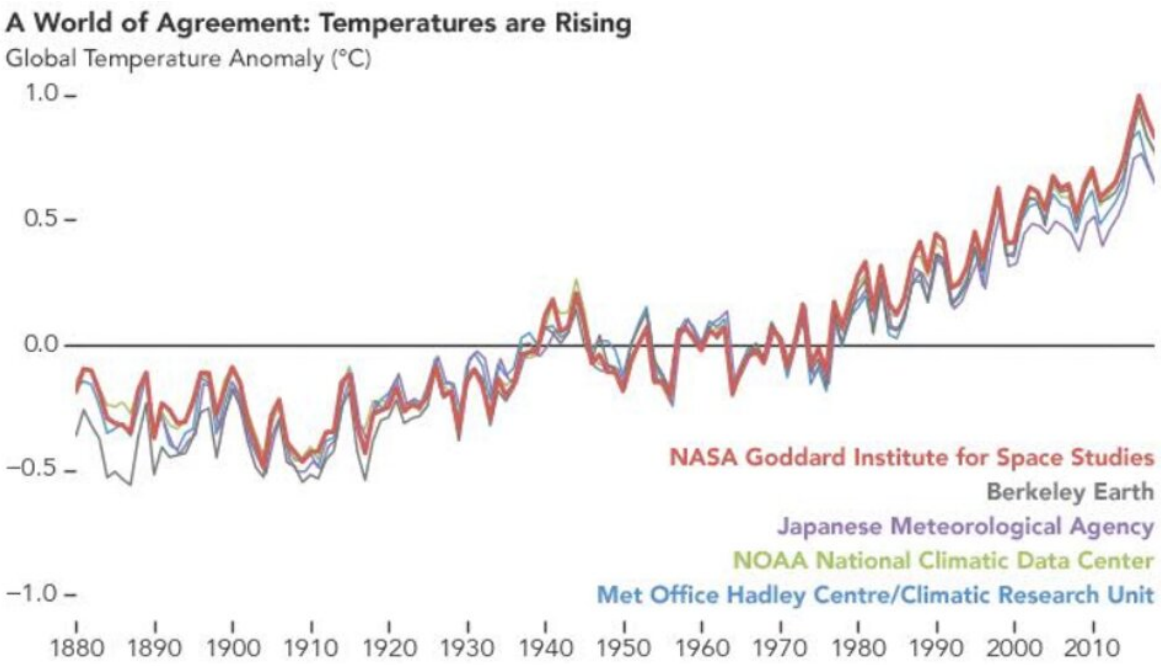
This is not true and a simplistic device used to attack the credibility of climate scientists. It would require a conspiracy covering thousands of scientists in more than a 100 countries to reach the scale required to do

this.

Scientists do correct and validate data all the time. For example we have to correct historic temperature records as how they were measured has changed. Between 1856 and 1941, most sea temperatures were measured using seawater hoisted on deck in a bucket. Even this was not consistent as there was a shift from wooden to canvas buckets and from sailing ships to steamships, which altered the height of the ship's deck—and these changes in turn altered the amount of cooling caused by evaporation as the bucket was hoisted onto deck. Since 1941, most measurements have been made at the ship's engine water intakes, so there's no cooling from evaporation to account for.

We must also take account that many towns and cities have expanded and so that meteorological stations that were in rural areas are now in urban areas which are usually significantly warmer than the surrounding countryside.

If we didn't make these changes to the original measurements, then Earth's warming over the last 150 years would have appeared to be even greater than the change that has actually been observed, which is now about 1°C of global warming.




Reconstruction of global temperatures from 1880 to 2018 by five independent international groups of scientists. Credit: NASA, CC BY

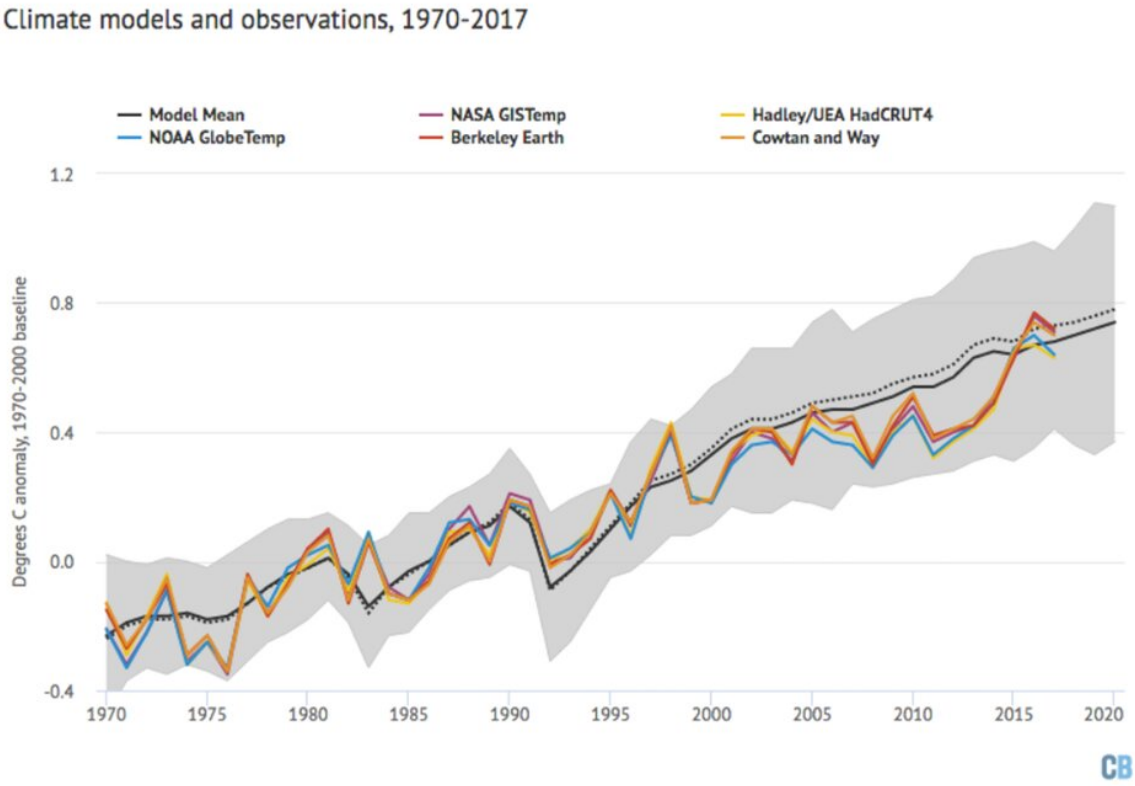
**5. Climate models are unreliable and too sensitive to carbon dioxide**

This is incorrect and misunderstands how models work. It is a way of downplaying the seriousness of future climate change. There is a huge range of climate models, from those aimed at specific mechanisms such as the understanding of clouds, to general circulation models (GCMs) that are used to predict the future climate of our planet.

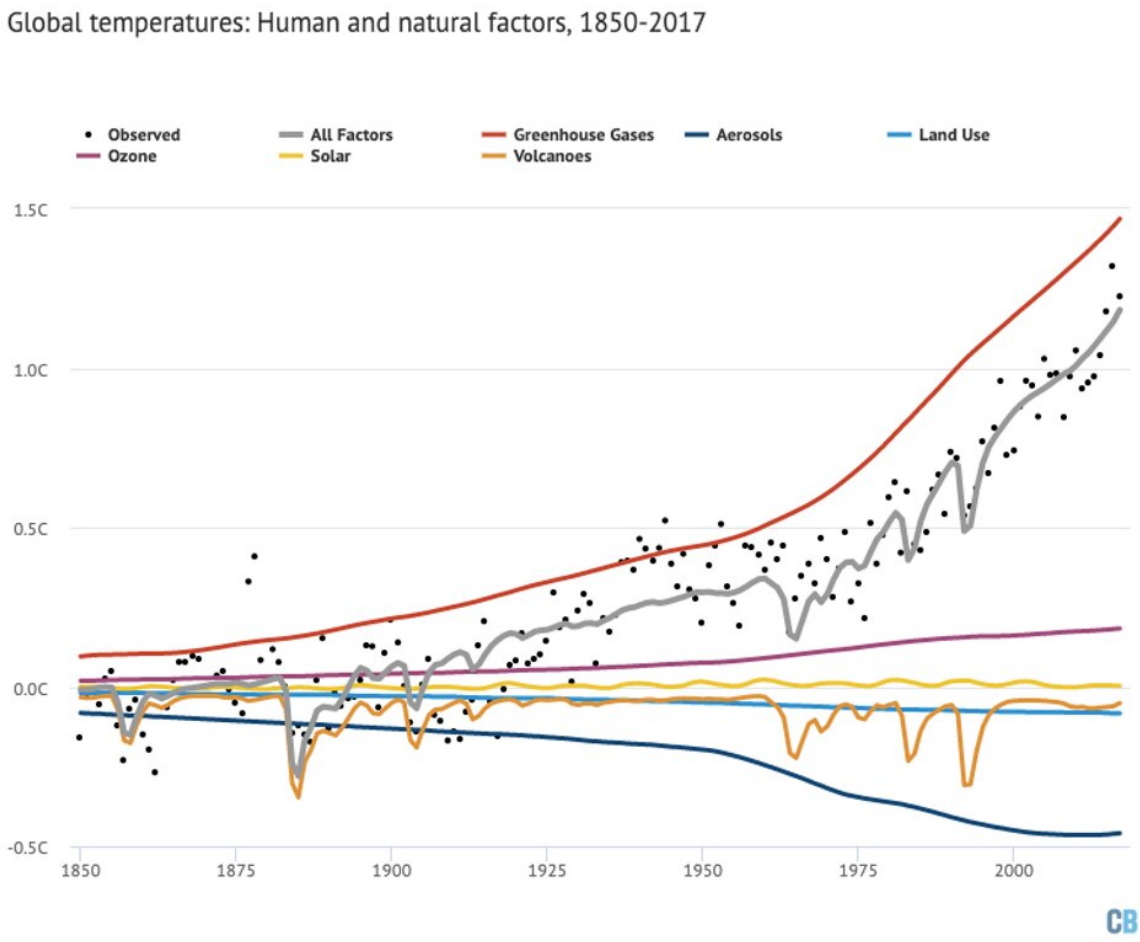
There are over 20 major international centers where teams of some of smartest people in the world have built and run GCMs containing millions of lines of code representing the very latest understanding of the climate system. These models are continually tested against historic and palaeoclimate data as well as individual climate events such as large

volcanic eruptions to make sure they reconstruct the climate, which they do extremely well.

No single model should ever be considered correct as they represent a very complex global climate system. But having so many different models constructed and calibrated independently means that we can have confidence when the models agree.




Model reconstruction of global temperature since 1970, average of the models in black with model range in grey compared to observational temperature records from NASA, NOAA, HadCRUT, Cowtan and Way, and Berkeley Earth. Credit: Carbon Brief, CC BY




Natural and Human influences on global temperatures since 1850. Credit: Carbon Brief, CC BY

Taking the whole range of climate models suggests a doubling of carbon dioxide could warm the planet by 2°C to 4.5°C, with an average of 3.1°C. All the models show a significant amount of warming when extra carbon dioxide is added to the atmosphere. The scale of the predicted warming has remained very similar over the last 30 years despite the huge increase in the complexity of the models, showing it is a robust outcome of the science.

By combining all our scientific knowledge of natural (solar, volcanic, aerosols and ozone) and human-made (greenhouse gases and land-use changes) factors warming and cooling the climate shows that 100% of the warming observed over the last 150 years is due to humans.

There is no scientific support for the continual denial of climate change. The Intergovernmental Panel on Climate Change (IPCC), set up by the United Nations to openly and transparently summarize the science, provides six clear lines of evidence for climate change. As extreme weather becomes more and more common, people are realizing that they do not need scientists to tell them the climate is changing—they are seeing and experiencing it first hand.

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