

# Climate Change 101: What Is Climate Change?

*Earth911*

*This article is the first of five in a series to understand the basics of climate change science.*

Globally, there is no doubt that the climate is changing as a result of human activity. Even in the United States, where [climate denial](#) is most common, the majority of people know that anthropogenic, or human-caused, climate change is real. Climate science is complicated, and in the atmosphere of misinformation that dominates the American discourse, few of us can claim to understand it.

If you are not as clear on climate change as you'd like to be, let this be your introduction to climate science basics. Welcome to Climate Change 101.

## Climate What?

For many people, the confusion begins with what to call it. But the various names begin to make sense with a bit of background.

Beginning in the second half of the 20<sup>th</sup> century, scientists noticed a global upward trend in temperatures. They attributed this change in the “greenhouse effect” to increased amounts of greenhouse gases accumulating in the atmosphere as a result of human industrial activity. They called this phenomenon “global warming.”

Scientists soon realized that elevated greenhouse gas levels did more than just raise the temperature. It sets off a cascade of complex shifts to weather and climate systems. These disrupted patterns resulted in more frequent and more extreme weather events, redistribution and decimation of wildlife populations, and many other changes. The term “global warming” gave way to “climate change” as a way to more accurately describe this complex set of climate effects.

More recently, the terms “climate emergency” and “climate crisis” have begun to [replace climate change](#). As climate change has progressed, the impacts have begun to be felt instead of predicted, and they are severe enough to qualify as a crisis.

## Greenhouse Gases

Earth is habitable because of its atmosphere, which consists of six layers of various gases that protect us from space and radiation, as well as support the atmosphere on which we depend. Not only do these gases make up the air we breathe at the earth's surface, but their accumulation around the planet acts like the glass in a greenhouse, trapping heat inside. Without the greenhouse effect of these gases, the average temperature on the planet would be [about 60 degrees Fahrenheit \(33 degrees Celsius\) colder](#).

The exact composition of the atmosphere has some natural variability. Factors such as seasonal changes, oceanic cycles, and the solar [Schwabe cycle](#) influence the

concentration of gases like carbon dioxide in the atmosphere. Using ice core samples, scientists can measure [historical concentrations](#) of carbon dioxide in the air. During the previous 400,000 years, the natural variation in atmospheric carbon dioxide levels was between 200 and 280 parts per million.

There are many greenhouse gases (GHGs), including methane, nitrous oxide, fluorinated gases, and carbon dioxide. Although carbon dioxide is not the most potent greenhouse gas, it is the most significant to climate change. This is because of the vast quantity that has been released to the atmosphere and the very long time that it stays there – from 300 to 1,000 years. In the 1800s, the concentration of carbon dioxide in the atmosphere was about [280 parts per million](#); today it is more than 415 parts per million and [increasing rapidly](#).

## Weather vs Climate

Many people confuse the [weather and the climate](#). Weather is the immediate local state of the atmosphere and its short-term variation over the course of days or weeks. Climate is weather patterns averaged over a long period of time – 30 years or more. Climate encompasses the statistical probability of normal weather and the range of weather extremes for a location. It is possible to experience low temperatures – even unusually low temperatures – even while the average is going up.

Imagine a math class where the average test score is 85 percent. Among the students, there could be some with a perfect score, others who failed the test, and no one with a score of exactly 85. In this example, the weather is each student's individual test score. The climate is the class average and the number of students who are likely to pass.

A massive amount of heat energy is needed to raise Earth's average yearly surface temperature even a small amount. Nevertheless, the global average surface temperature has increased by 3.6°F (2°C) in the past 140 years, and the change is picking up speed. The [global annual temperature](#) increased at an average rate of 0.13°F (0.07°C) per decade since 1880 and more than twice that rate since 1981.

## Scientific Consensus

Science is based on the rejection of absolute certainty. That means scientists must always be willing to accept new evidence that disproves established facts. People often misunderstand this open-mindedness towards new information as an indictment against existing data. Here again, it's important to understand the [vocabulary](#). The meanings of many words are more specific in scientific usage than in general conversation.

In science, a fact is a confirmed observation – a piece of data. It is a fact that carbon dioxide concentrations in the atmosphere have increased by nearly 140 ppm in less than two centuries. A scientific law is a detailed description of facts, usually expressed mathematically.

A hypothesis is a tentative explanation about a fact or a law that can be tested through experimentation and [modeling](#). "Climate change is a result of natural forces," is a hypothesis. "Climate change is caused by human activity," is another hypothesis.

A scientific [theory](#) is an explanation that has been tested and is supported by facts,

tests, and laws. Evolution is “just a theory,” but so is gravity. A theory is the best explanation for all the evidence we have so far.

In politics, a consensus is reached through discussion. In science, consensus is numerical. It is the accumulation of peer-reviewed studies that independently reach the same conclusions. When peer-reviewed studies published by climate scientists are counted, [97 percent of them](#) support the theory that human activity has caused climate-warming trends over the past century.

## **So What Is Climate Change?**

Climate change is the environmental crisis created by greenhouse gases released into the atmosphere by human industrial activity.

*The second article in this series will deal with the causes of climate change and explain how human action drives the process.*

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