

WHAT IS CLIMATE CHANGE



1. Climate Change Cycles

The Earth has experienced seven cycles of glacial advance and retreat over the last 650,000 years. The last ice age ended 7,000 years ago. The current warming period is happening much faster than past changes, and 95% of climate scientists agree that human activity since the mid-20th century is the cause. Weather is the localized climate of any given location, and it changes frequently, and climate is the average long-term weather conditions.

2. Greenhouse Effect

The greenhouse effect is the phenomenon of Earth's atmosphere holding energy from the Sun. Solar energy reflected from Earth's surface is absorbed by the atmosphere instead of radiating back into space. Greenhouse gases in the atmosphere trap solar energy to direct back to Earth. The reflected energy heats the lower atmosphere and the planet's surface. Some trapped heat has to radiate back to Earth to maintain a temperature able to support life however the atmosphere is currently holding in too much solar energy.

3. Greenhouse Gases

The Greenhouse gases are carbon dioxide, methane, nitrous oxide, and fluorinated gases. Natural sources of carbon dioxide include volcanic eruptions and normal respiration of plants and animals, but natural sources are insignificant compared to carbon dioxide from human activity. Carbon dioxide in the atmosphere has increased by more than a third since the industrial revolution. Though the gases do dissipate on their own eventually, they stay in the atmosphere for a long time. If all human activity releasing greenhouse gases stopped today, it would take hundreds of years for the carbon dioxide in the atmosphere to drop back to pre-industrial levels.

4. Sea Levels

Satellite data shows that global sea levels are rising by an average of 3 millimeters per year. A significant proportion of increased sea levels is from the thermal expansion of seawater. Molecules of water are packed together when they are cold. The water molecules spread out as temperatures rise, and this results in more volume in the oceans. Melting mountain glaciers and polar ice sheets are also contributing to rising sea levels. The majority of glaciers in temperate regions and the Antarctic Peninsula are shrinking by an average of 4% each decade. Some glaciers, such as those in the Greenland Ice Sheet, are melting much more quickly.

5. Methane

Methane is a hydrocarbon gas. It comes from natural sources and human activities such as decomposing waste in landfills and agriculture. Rice cultivation produces more methane than almost any other crop. Cattle digesting food and the management of manure add methane to the atmosphere as well. Methane is much more active and harmful than carbon dioxide, but there isn't much methane in the atmosphere. There are large pockets of methane frozen under ice sheets. Some pockets are very close to the surface now due to years of melting ice. Researchers are monitoring large pockets of gas under thin ice because the impact on the atmosphere if released could be devastating to the environment.

6. Chlorofluorocarbons and Nitrous Oxide

Chlorofluorocarbons, or CFCs, are a very potent and harmful greenhouse gas that also destroys the ozone layer. They are entirely synthetic, so there are no natural sources. CFCs used to be heavily utilized in industry, but their use is strictly regulated now. Unfortunately, the regulations are not standard worldwide. Nitrous oxide is produced by soil cultivation, especially when commercial or organic fertilizer is used. Other sources of nitrous oxide are fossil fuel combustion, nitric acid production, and burning of biomass.

7. Human Activity

Burning fossil fuels is the main culprit of increasing greenhouse gases. Burning coal and oil produces carbon dioxide by combining oxygen in the air with carbon. Clearing land for agriculture, industry, and other human activities contribute carbon dioxide to a lesser extent than fossil fuels. Human activities often occur in a manner that multiplies negative effects on the atmosphere. Each person uses resources, and the population of humans worldwide is rising steadily. The resources used by the larger population often involve burning fossil fuels, while more land may be cleared for agriculture. Carbon sinks, such as forested areas, decline as burning fossil fuels increase.

8. Evidence

Satellites and other technology let scientists examine conditions on Earth on a large scale. Ice cores from Greenland, Antarctica, and glaciers on tropical mountains provide evidence that greenhouse gas concentrations influence Earth's climate. Ancient evidence is found in tree rings, ocean sediments, sedimentary rock layers, and coral reefs. The information obtained from these sources clearly shows that the current warming period is happening approximately ten times faster than the average warming period.

9. Effect on Weather

Climate change contributes to severe weather events and disasters in several ways. The mechanism driving these changes is extensively researched and documented by researchers. Warm air holds more water vapor than cool air. The extra moisture causes more severe storms. Warmer air and warmer oceans alter currents such as El Nino and the Gulfstream. Severe, long-term droughts influence weather as well. The right conditions for a polar vortex occur more often, and then the polar vortex influences the weather patterns too. Each weather event and change has an effect, and a feedback loop develops.

10. Effects of Global Warming

The effects of climate change are on such a large scale it is hard to label any single weather event as a direct consequence. Tracking and monitoring events across the globe over the course of decades gives scientists information to make predictions and analyze various factors influencing severe weather events. Stark changes are noticeable on satellite images. The Sahara desert on the African continent is growing. Wildfire in western states in the US are massive with multiple fires raging simultaneously. Hurricane Michael was the third-most powerful hurricane to ever make landfall in the US, and record-breaking storms are no longer rare. Flooding and droughts create havoc in places around the globe.

Climate change is real and caused by humans

The IPCC is not the only scientific group that has reached a clear consensus on the scientific evidence of human-caused global warming. As this NASA page points out, 200 global scientific organizations, 11 international science academies, and 18 American science associations have released statements in alignment with this consensus. The scientific consensus that climate change is happening and that it is human-caused is strong. Scientific investigation of global warming began in the 19th century, and by the early 2000s, this research began to coalesce into confidence about the reality, causes, and general range of adverse effects of global warming. This conclusion was drawn from studying air and ocean temperatures, the atmosphere's composition, satellite records, ice cores, modeling, and more. In 1988 the United Nations and World Meteorological Organization founded the Intergovernmental Panel on Climate Change, IPCC, to provide regular updates on the scientific evidence on global warming. In a 2013 report, the IPCC concluded that scientific evidence of warming is "unequivocal" and that the largest cause is an increase of carbon dioxide in the atmosphere as a result of humans burning fossil fuels. The IPCC continues to assess this science, periodically issuing new reports.

<https://yaleclimateconnections.org/2022/02/scientists-agree-climate-change-is-real-and-caused-by-people/>