What is climate change?

https://www.bbc.com/news/science-environment-24021772?app=news.science_and_environment.story.24021772.page

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The planet's climate has always been changing across time. The global average temperature today is about 15 Celsius (59 Fahrenheit), though it has probably been much higher and lower in the past. However, this current period of warming is happening much faster than many past periods. Scientists are concerned that natural changes in the climate are being overtaken by a fast, human-caused warming that has serious impact on the planet's climate.

What is the “greenhouse effect”?

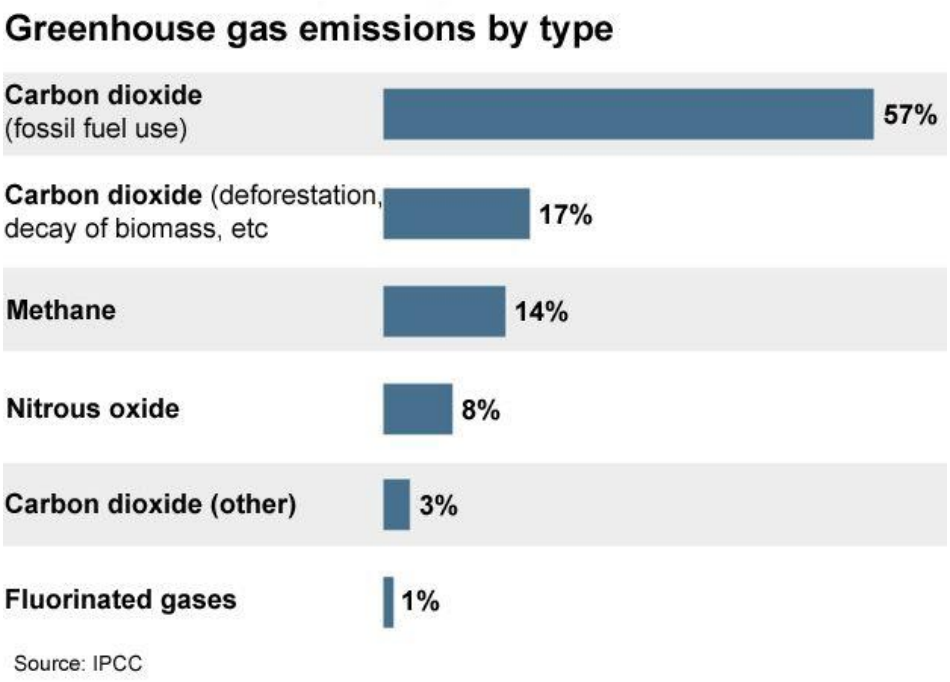
The *greenhouse effect* describes the way the Earth's atmosphere traps some of the energy from the Sun, which is called solar energy. Solar energy spreading out to space from the Earth's surface is taken in by greenhouse gases and then spread in all directions. The energy that comes back down to the planet heats both the lower atmosphere and the surface of the earth. Without the greenhouse effect, the Earth would be about 30C colder, making it hard for living things on our planet.

Scientists believe we are adding to this natural greenhouse effect with gases released from industry and farming (known as “emissions”). More energy is being trapped, which is increasing the temperature. This is commonly called global warming or climate change.

Carbon dioxide (CO_2) is a greenhouse gas that stays in our atmosphere for a long time. It would take hundreds of years for the level of carbon dioxide to return to the levels before the Industrial Revolution. Also, there is only so much CO_2 that can be soaked up by natural pools such as our oceans.

Most man-made release of CO_2 happens through the burning of fuels. Forests are natural carbon takers, but when they are cut down and left to rot, or burned, that stored carbon is also released, adding to global warming. Other greenhouse gases like methane and nitrous oxide are also released through human activities, but their amount is small compared with carbon dioxide.

Since the Industrial Revolution began in around 1750, CO_2 levels have risen by more than 30% and methane levels have risen more than 140%. The amount of CO_2 in the atmosphere is now higher than at any time in at least 800,000 years.



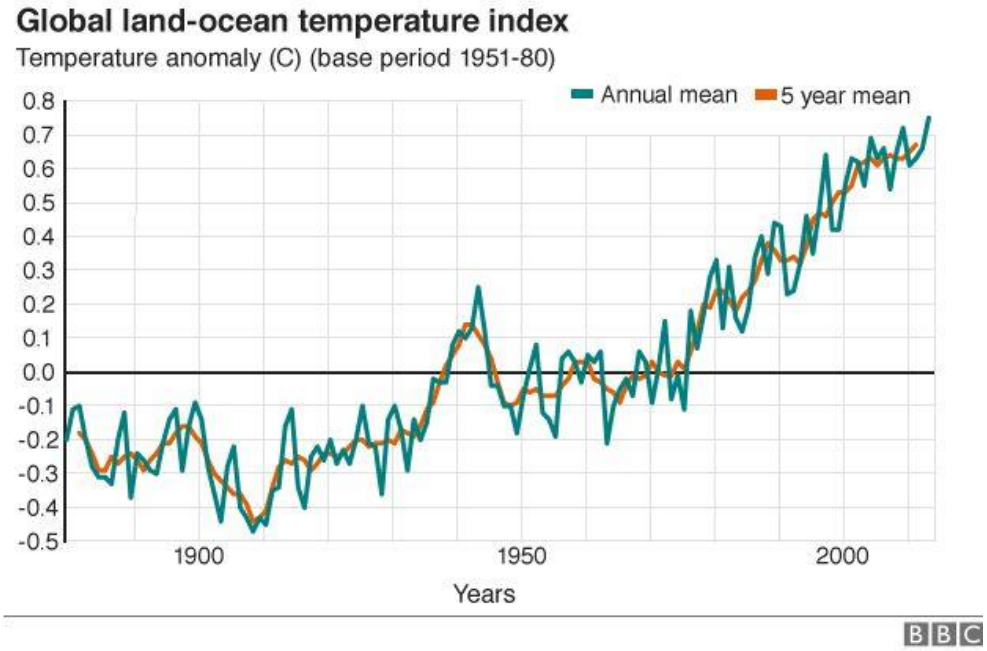
What is the evidence for warming?

The global average temperature for the first 10 months of 2018 was almost 1C above the levels of 1850-1900, and the 20 warmest years on record have all happened in the past 22 years.

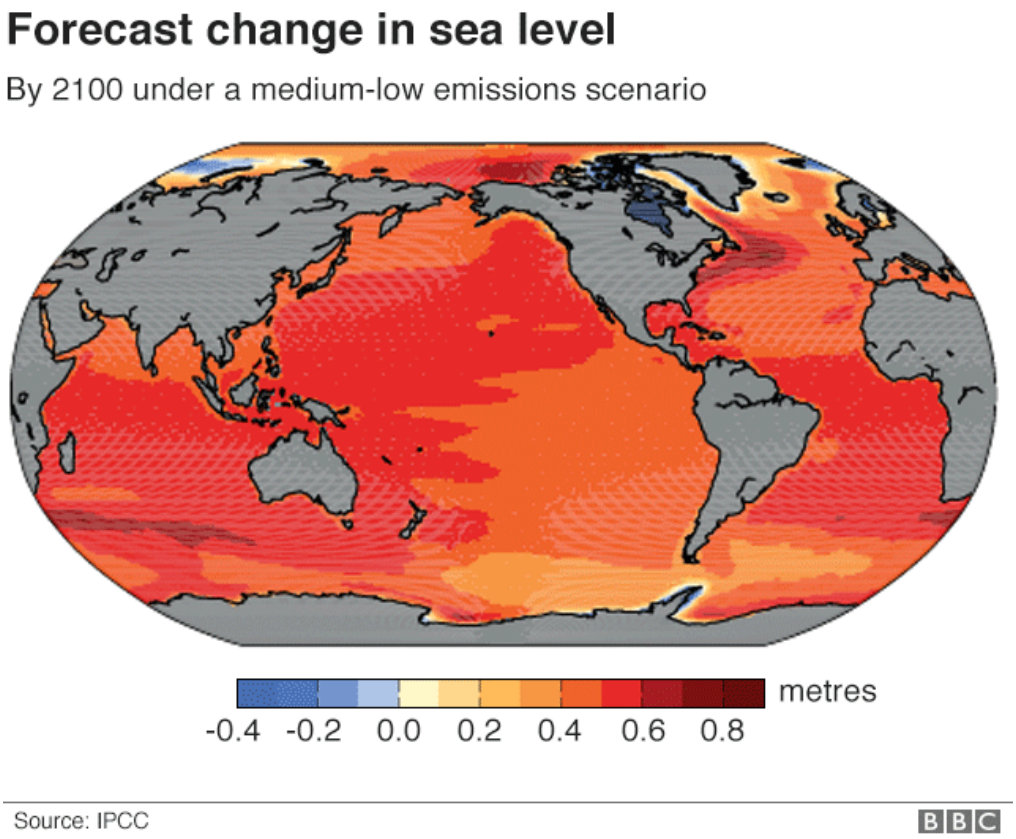
Across the globe, the average sea level increased over 2005-2015. Most of the change in sea level was once thought to be by the *thermal expansion* of seawater. Thermal expansion happens because when water is heated, its molecules move more and separate farther from each other. So, as seawater warms up, the molecules become less packed, causing an increase in the volume of the ocean.

But ice losses at the poles of the earth are now believed to be the major driver of the growing sea level. Many glaciers in the world are in retreat, which means that they are shrinking. Since 1979, satellites have shown a powerful drop in the Arctic's ice. In 2012, the ice level reached a record minimum that was 50% lower than the 1979-2000 average. The Greenland Ice Sheet has gone through record melting in recent years. If the entire sheet were to melt, it would raise sea levels by 6 meters. The West Antarctic Ice Sheet is also losing size, and a recent study showed that East Antarctica may also have started to lose ice in the last few years. But scientists are not imagining dramatic changes here. In some places, mass may actually grow as warming temperatures drive more snow.

The effects of a changing climate can also be seen in plant life and land animals. These include earlier flowering and fruiting times for plants and changes in the environments where animals live.



Source: Nasa GISS



How much will temperatures rise in the future?

Most computer simulations suggest that global surface temperature change by the end of the 21st Century is likely to go above 1.5C, compared to 1850. The World Meteorological Organization (WMO) says that if the current warming continues, temperatures could rise by 3-5C by the end of this century.

A change of 2C had long been thought of as the opening to dangerous warming. More recently, scientists and law makers have argued that keeping temperature rise to within 1.5C is a safer limit for the world. But keeping to the 1.5C target would require fast and far-reaching changes in all parts of society.

Even if we cut greenhouse gas emissions now, scientists say the impact will continue because parts of the climate system, especially large bodies of water and ice, can take hundreds of years to respond to changes in temperature. It also takes greenhouse gases decades to be removed from the atmosphere.

Getty Images Image caption: Climate change could cause more extremes of weather

How will climate change affect us?

The degrees of impact on us is still uncertain, but the changes could drive freshwater shortages, bring changes to our ability to produce food, and increase the number of deaths from floods, storms, heat waves and droughts. This is because climate change is expected to increase extreme weather events. Scientists predict more rainfall in the world overall but say the risk of drought in inland areas during hot summers will increase. More flooding is expected from storms and rising sea levels. There are, however, likely to be very strong regional differences.

Poorer countries, which are least prepared to deal with these changes, could suffer the most.

Plant and animal extinctions are predicted the environment changes faster than animals can adapt, and the World Health Organization (WHO) has warned that the health of millions could be threatened by rises in malaria from mosquitos, diseases from dirty water, and less food available.

As more carbon dioxide is released into the atmosphere, there is increased intake of CO_2 by the oceans, and this causes the water to become more *acidic*. This acid could cause major problems for the world's coral reefs, as the changes in water chemistry prevent corals from making a hardened skeleton, which is key to their survival.

Computers are used to study the changing of the Earth's climate and make predictions about future temperature change. But these climate simulations differ on *climate sensitivity*. They do not always agree on how the temperature will change. Computers also differ on *climate feedbacks*. Global warming will cause some changes that look likely to create further heating, such as the release of large amounts of the greenhouse gases. This is known as a *positive climate feedback*. But *negative feedbacks* can balance the warming. For example, natural pools of water on Earth absorb CO2.