

Ten common questions and answers on climate science

This FAQ is offered by the Royal Society to give authoritative answers, based on the latest science, to questions that bishops and their communities may face when they discuss climate change.

“Climate change is one of the defining issues of our time. Looking at the evidence and the analysis by expert climate scientists, it is becoming increasingly certain that we are changing the Earth’s climate. Human activities – especially the burning of fossil fuels since the start of the Industrial Revolution – have increased the CO₂ concentrations in our atmosphere by about 40%. Since 1900, the global average surface temperature has increased by about 0.8 °C, and we have seen a rise in sea level, a strong decline in Arctic sea ice, and many other linked effects.

“Extreme weather such as heatwaves, hurricanes, floods and droughts, can have a huge impact on people’s lives and livelihoods and many poor communities are already highly vulnerable. Societies are not resilient enough to the extreme weather being experienced today. How climate change affects extreme weather is still unclear, but this uncertainty, as well as the growing population, can only make it harder for people to cope, adapt and develop in the face of these challenges.

“People and governments can choose how to respond to climate change. They can alter how they produce and use energy; they can simply wait, and accept any losses and suffering that arise; they can adapt to changes as much as possible; or they can attempt as yet unproven ‘geoengineering’ solutions to counteract some of the climate changes ahead. Each option has risks, attractions and costs. What is certain is that the choices that are made will affect our shared future here on Earth.”

Sir Paul Nurse,
President of the Royal Society

1. Is the climate warming? Yes. Earth’s average surface air temperature has increased by about 0.8 °C since 1900, with much of this increase taking place since the mid-1970s. A wide range of other observations such as sea-level rise, reduced Arctic sea ice extent and increased ocean heat content provide incontrovertible evidence of a warming Earth.

2. How confident are scientists that Earth will warm further over the coming century? Very confident. If emissions continue on their present trajectory, then warming of 2.6 to 4.8 °C, in addition to that which has already occurred, would be expected by the end of the 21st century. The range of values accounts for the fact that there are open questions as to how exactly some natural processes such as cloud formation amplify or reduce the direct warming effect of increasing levels of CO₂.

3. Are climate changes of a few degrees a cause for concern? Yes. Even though an increase of a few degrees in global average temperature does not sound like much, global average temperature during the last ice age was only about 4 to 5 °C colder than now. Global warming of just a few degrees will be associated with widespread changes in regional and local temperature and rainfall as well as with increases in some types of extreme weather events. These and other changes (such as sea level rise and storm surges) will have serious impacts on human societies and the natural world.

4. How does extreme weather affect people in developing countries?

Extreme weather, such as floods, droughts, hurricanes and tornadoes, can have a huge impact on people’s lives and livelihoods: from death and injury through to long-term impacts on school attendance, nutrition, health and inequality. It can be a significant barrier to sustainable development and can prevent people escaping from poverty, or pull them back into it. The impact is not the same for all of us; although financial losses are far higher

in developed countries in absolute terms, loss of life and economic loss as a percentage of GDP are higher in developing countries. The sheer extent of current damage shows that the most vulnerable societies are not well adapted to the extreme weather they are facing.

5. How does climate change affect the strength and frequency of floods, droughts, hurricanes and tornadoes? Earth's lower atmosphere is becoming warmer and moister as a result of human-emitted greenhouse gases. This means that unusually warm spells (heatwaves) are becoming more common, and more water is likely to be drawn into major rain storms, which could lead to more flooding events. There is considerable uncertainty over changes in hurricanes and tornadoes, but the extra energy available may make the strongest hurricanes stronger. Dry areas of the subtropics are expected to become drier in the future. The rise in sea level will exacerbate the effects of coastal flooding unless protective measures are taken.

6. How do scientists know that recent climate change is largely caused by human activities? Human activity leads to emissions of greenhouse gases (causing warming), and of other pollutants that produce small particles in the atmosphere (which can have both cooling and warming effects). The dominant influence of human activities on recent climate change is clear from an understanding of the basic physics of the greenhouse effect and from comparing the detailed patterns of recent climate change with those expected from different human and natural influences. Only when human influences on the composition of the atmosphere are incorporated can models reproduce observed changes in climate.

7. Climate is always changing. Why is climate change of concern now? All major climate changes, including natural ones, are disruptive. Past climate changes led to extinction of many species, population migrations, and pronounced changes in the land surface and in ocean circulation. The speed of the current climate change makes it more difficult for human societies and the natural world to adapt.

8. CO₂ is already in the atmosphere naturally, so why are emissions from human activity significant?

Human activities have significantly disturbed the natural carbon cycle by extracting long buried fossil fuels and burning them for energy, thus releasing CO₂ to the atmosphere. The concentration of CO₂ has increased by 40% since the Industrial Revolution.

9. Is the current level of atmospheric CO₂ concentration unprecedented in Earth's history? The present level of atmospheric CO₂ concentration is almost certainly unprecedented in the past million years, during which time modern humans evolved and societies developed. The atmospheric CO₂ concentration was however higher many millions of years ago, at which time temperatures and sea levels were also higher than they are today.

10. If emissions of greenhouse gases were stopped, would the climate return to the conditions of 200 years ago? No. Even if human emissions of greenhouse gases were to suddenly stop, Earth's surface temperature would not cool and return to the level it was at before the Industrial Revolution for thousands of years because CO₂ is only removed from the atmosphere over these very long time scales.

For more details download *Climate Change: Evidence and Causes*, from our website, royalsociety.org

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