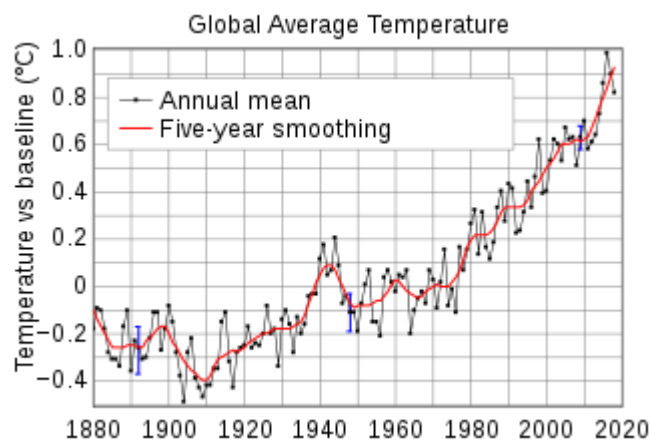


# Global warming

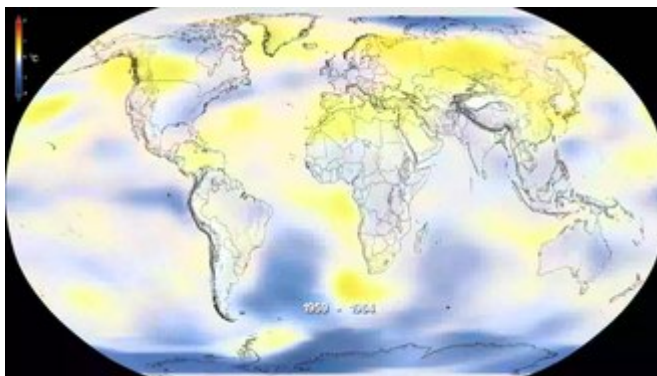
**Global warming** is the long-term rise in the average temperature of the Earth's climate system. It is a major aspect of current climate change, and has been demonstrated by direct temperature measurements and by measurements of various effects of the warming.<sup>[1][2]</sup> The term commonly refers to the mainly human-caused increase in global surface temperatures and its projected continuation.<sup>[3][4]</sup> In this context, the terms *global warming* and *climate change* are often used interchangeably,<sup>[5]</sup> but *climate change* includes both *global warming* and its effects, such as changes in precipitation and impacts that differ by region.<sup>[6]</sup> There were prehistoric periods of global warming,<sup>[7]</sup> but observed changes since the mid-20th century have been much greater than those seen in previous records covering decades to thousands of years.<sup>[1][8]</sup>

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report concluded, "It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century."<sup>[9]</sup> The largest human influence has been the emission of greenhouse gases such as carbon dioxide, methane, and nitrous oxide. Climate model projections summarized in the report indicated that during the 21st century the global surface temperature is likely to rise a further 0.3 to 1.7 °C (0.5 to 3.1 °F) in a moderate scenario, or as much as 2.6 to 4.8 °C (4.7 to 8.6 °F) in an extreme scenario, depending on the rate of future greenhouse gas emissions and on climate feedback effects.<sup>[10]</sup> These findings have been recognized by the national science academies of the major industrialized nations<sup>[11]</sup> and are not disputed by any scientific body of national or international standing.<sup>[12][13]</sup>

The effects of global warming include rising sea levels, regional changes in precipitation, more frequent extreme weather events such as heat waves, and expansion of deserts.<sup>[14]</sup> Surface temperature increases are greatest in the Arctic, which has contributed to the retreat of glaciers, permafrost, and sea ice. Overall, higher temperatures bring more rain and snowfall, but for some regions droughts and wildfires increase instead.<sup>[15]</sup> Climate change threatens to diminish crop yields, harming food security, and rising sea levels may flood coastal infrastructure and force the abandonment of many coastal cities.<sup>[16][17]</sup> Environmental impacts include the extinction or relocation of many species as their ecosystems change, most immediately the environments of coral reefs,<sup>[18]</sup> mountains, and the Arctic.<sup>[19]</sup> Because the climate system has a large "inertia" and greenhouse gases persist in the atmosphere, climatic changes and their effects will continue for many centuries even if greenhouse gas emissions are stopped.<sup>[20]</sup>



The average annual temperature at the earth's surface has risen since the late 1800s, with year-to-year variations (shown in black) being smoothed out (shown in red) to show the general warming trend.



Play media

Since the late 1800s, temperatures in different geographic locations have increased by different amounts, shown by a changing pattern of growing intensities of red.

Possible societal responses to global warming include mitigation by emissions reduction, adaptation to its effects, and maybe climate engineering. Countries work together on climate change under the umbrella of the United Nations Framework Convention on Climate Change (UNFCCC), which has near-universal membership. The ultimate goal of the convention is to prevent dangerous anthropogenic climate change.<sup>[21]</sup> Although the parties to the UNFCCC have agreed that deep cuts in emissions are required<sup>[22]</sup> and that global warming should be limited to well below 2 °C (3.6 °F) in the Paris Agreement,<sup>[23]</sup> the Earth's average surface temperature has already increased by about half this threshold.<sup>[24]</sup> and current pledges by countries to cut emissions are inadequate to limit future warming.<sup>[25]</sup> Some scientists question the feasibility, in higher emissions scenarios, of climate adaptation.<sup>[26]</sup>

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