

2001-2010 had the warmest temperatures globally

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The World Meteorological Organization (WMO) released a report last month showing that the Earth experienced unprecedented climate extremes in the last decade, the warmest period since measurements were first taken in 1850. More national temperature records were broken than in any previous decade.

According to the report, “The Global Climate 2001-2010, A Decade of Climate Change,” the first ten years of the 21st century were the warmest decade for both hemispheres and for both land and ocean surface temperatures. There were also many extreme-weather events, including floods, droughts and cyclic storms. The rising temperatures are responsible for the rapid melting of Arctic sea ice and Antarctic ice sheets and the thermal expansion of seawater, doubling the average annual increase in mean sea level from the last century.

The increase in average global temperature is caused by rising concentrations of greenhouse gases in the atmosphere. In 2010, global carbon dioxide concentration rose to 389 parts per million, an increase of 39 percent since the beginning of the industrial era in 1750, as shown by analysis of gas bubbles found in core samples taken from Antarctic ice. The concentration of methane rose to 1808.0 parts per billion (up 158 percent) and of nitrous oxide to 323.2 parts per billion (up 20 percent).

Greenhouse gases raise global temperatures by preventing thermal radiation emitted from the surface of the Earth from escaping back to space. When light from the Sun passes through the atmosphere, visible light is absorbed by the surface of the Earth. Infrared light, on the other hand, is radiated back into space. It is only because of greenhouse gases that this heat stays near the surface, an effect that makes it warm enough for liquid water to exist. A similar process, differing

mainly in degree, plays a significant role in producing the hellish climate of the planet Venus, the hottest planet in the solar system with an average surface temperature of 460°C (860°F).

The average land and ocean-surface temperature for 2001-2010 was 14.47°C (58.05°F), which was 0.47°C (0.85°F) hotter than the 1961-1990 average and 0.21°C (0.38°F) hotter than the 1991-2000 average. Every year of 2001-2010 except for 2008 was among the hottest ten years on record. 94% of countries surveyed by the WMO reported their warmest decade. Severe heat waves killed over 1,000 people in India in 2002 and 2003. The 2003 summer heat wave caused more than 66,000 deaths in Europe. An exceptionally intense heat wave caused over 55,000 deaths in July/August 2010 in Russia.

The past decade was also the second wettest decade since the 1950s, with 2010 being the wettest year ever recorded globally. Most parts of the world had above-normal precipitation. From the WMO report: “because warm air can hold more moisture, it is likely that climate change has influenced the occurrence and intensity of extreme precipitation events. Greater warmth also speeds up the hydrological cycle, which should contribute to both heavier rainfall and increased evaporation.”

The WMO survey additionally revealed that floods were the most commonly experienced extreme weather event. Floods struck Eastern Europe in 2001 and 2005, India in 2005, Africa in 2008, Pakistan in 2010 and Australia in 2010. Concurrently, large-scale droughts occurred all over the world. Australia in 2002 and other years, East Africa in 2004 and 2005, and the Amazon Basin in 2010 all experienced long-term droughts that resulted in significant loss of life and negative environmental impacts.

The decade 2001-2010 was the most active since 1855 for tropical cyclones in the North Atlantic Basin, recording 15 named storms per year, up from the long-term average of 12. The most active season ever recorded was 2005 with 27 named storms, including Hurricane Katrina, from which New Orleans has yet to fully recover. The deadliest storm of the decade was Nargis in the north Indian Ocean, which struck Myanmar in May 2008. More than 138,000 people were killed or missing, eight million people were affected, and thousands of homes were destroyed.

In the course of the decade, more than 370,000 people died because of extreme climate, including heat waves, cold spells, drought, storms and floods, a 20 percent increase from 1991-2000. This increase was mainly due to heat wave deaths, which were up more than 20 times, from less than 6,000 to 136,000. Despite increased populations in disaster-prone areas, there was a 16 percent decline in storm deaths and a 43 percent decline in flood deaths, credited by the WMO report to better early warning systems and increased preparedness.

The record temperatures coincide with increasingly rapid melting of the world's ice caps, sea ice, glaciers, and permafrost. The sea ice over the Arctic Ocean has declined rapidly since the 1960s. Before then, arctic sea ice covered 7-9 million square kilometers (3 million square miles) at the end of summer and 14-16 million square kilometers (5-6 million square miles) in late winter. In September 2007, the end of the northern summer, the ice cap had its record minimum coverage of 4.28 million square kilometers (1.65 million square miles). The Septembers of 2005, 2007, 2008, 2009 and 2010 saw the five lowest figures in terms of recorded extent of sea ice.

Sea ice plays a significant role in global temperatures. Rather than absorbing light from the sun, ice reflects most of the light (and heat) back into space. Inversely, water absorbs more light and heat. Thus, when ice melts, more heat is absorbed by water, more ice melts, so even more heat is absorbed—one instance of a positive feedback loop in climate.

Ocean levels continued to rise over the decade, almost doubling in rate to 3 millimeters per year. During the 20th century, the rate of increase was 1.6 millimeters per year. Currently, the dominant factor in rising sea levels is thermal expansion, the expansion of water as a result of the world's oceans becoming

measurably warmer.

Another increasingly important factor in rising sea levels comes from melting ice sheets and glaciers, such as those on Antarctica and Greenland. Ice that hitherto was previously on land has melted, run off and thus been added to the total water volume of the oceans. Ice sheets, which form over landmasses, are melting at an accelerating rate. The Greenland and Antarctic ice sheets suffered their greatest loss of mass of the decade in 2007 and 2008. If the melting trend continues, warns the WMO report, ice sheet runoff will become the dominant factor in rising sea levels during the 21st century.

Melting sea ice does not contribute to rising water levels, since it is already floating on the surface of the ocean. Ice is less dense than water, and when transformed into a liquid takes up less space. (That is why, for example, when an ice cube in a glass of water melts, the glass does not overflow). But there are other detrimental effects.

The WMO report concludes that while the data on extreme weather of the past decade is not decisively linked to global warming, climate scientists agree that many of the events would have had less of an impact or possibly not occurred at all in the absence of climate change.



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