

Science update on climate change: from bad to worse

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Scientists monitoring the Earth's climate and environment have delivered a cascade of grim news this year, adding a sense of urgency to UN talks on how best to draw down the greenhouse gases that drive global

warming.

Here is a summary of recent findings:

1.1 degrees

Earth's average surface temperature last year was a record 1.1 degree Celsius (1.98 Fahrenheit) above the preindustrial era.

The planet's rising fever is caused by the accumulation of heat-trapping [greenhouse gases](#) in the atmosphere, especially [carbon dioxide](#) (CO₂) cast off when fossil fuels are burned to produce energy.

Sixteen of the hottest years on record have occurred since the start of the 21st century, and 2017 is on track to be the warmest year not affected by the El Nino weather phenomenon.

The 196-nation Paris Agreement calls on humanity to block the rise in temperature at "well below" 2 degrees Celsius (3.6 F) compared to preindustrial levels, and to strive for a cap of 1.5 C.

403.3 ppm

The atmospheric concentration of carbon dioxide (CO₂) reached an average of 403.3 parts per million (ppm) in 2016, the highest level in at least 800,000 years.

CO₂ emissions—after remaining stable for three years, raising hopes that they had peaked—will rise by two percent in 2017.

Concentrations of methane (CH₄), the second most important greenhouse gas, have also risen sharply over the last decade, driven by

leakage from the gas industry's fracking boom and growth in global livestock production.

Many climate scientists argue that capping CO₂ at 450 ppm offers a fighting chance at staying under the 2 C threshold. But others say the limit for a "climate safe" world is much lower, at about 350 ppm.

Melting ice

Arctic summer sea ice shrank to 4.64 million square kilometres (1.79 million square miles) in 2017, leaving ice extent well above the record low of 3.39 million square kilometres set in 2012.

But long-term trends are unmistakable: Arctic sea ice cover is declining at a rate of 13.2 percent per decade, relative to the 1981-2010 average.

Climate models predict the Arctic Ocean could be ice-free in summer as early as 2030.

At the other end of the world, Antarctic sea ice last year hit the lowest extent ever recorded by satellites.

Earth's two massive ice sheets—atop Greenland and Antarctica—are shedding 286 billion and 127 billion tonnes of mass per year, respectively.

High-altitude glaciers, meanwhile, suffered a decline in surface area in 2016 for the 37th year in a row.

Extreme events

The World Meteorological Organization (WMO) says there are

demonstrable links between [climate change](#) caused by human activity and some extreme weather events, especially heatwaves.

The number of climate-related extreme events—such as droughts, forest fires, floods and major storm surges—has doubled since 1990, research has shown.

2017 saw the first severe tropical storm known to sustain winds of 295 kilometres per hour (185 miles per hour) for more than 33 hours (Irma); and a hurricane that dropped a record 125 centimetres of water (nearly 50 inches) on land (Harvey).

The intensity of typhoons battering China, Taiwan, Japan and the Korean Peninsula since 1980, one study has shown, has increased by 12 to 15 percent.

Natural disasters drive about 26 million people into poverty every year, according to the World Bank, and cause annual losses of about \$520 million (440 million euros).

84.8 millimetres

Sea level rise—caused mainly by water expanding as it warms, as well as runoff from ice sheets and glaciers—is now 3.4 millimetres (0.13 inches) per year. Since 1993, the global ocean watermark has gone up by 84.8 mm (3.3 inches).

The pace is likely to pick up, threatening the homes and livelihoods of tens of millions of people in low-lying areas around the world.

Global warming is likely to add at least a metre (three feet) to the global watermark by century's end, according to recent estimates.

1,688 species

Of the 8,688 species of animals and plants listed as "threatened" on the International Union for the Conservation of Nature's (IUCN) Red List, 19 percent have been negatively affected by climate change.

Twenty-five years after 1,700 scientists issued a "warning to humanity" about environmental degradation, more than 15,000 experts updated the alert this month and noted that virtually all the planet's problems are getting "far worse".

Scientists say the planet has entered a "mass extinction event"—the sixth in the last half-billion years.

Sources: NASA, National Snow and Ice Data Center, WMO, peer-reviewed studies.

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