

The critical threshold of global warming may occur much earlier than preliminary forecasts

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Date: 12.08.2021 *Issue:* 8/2021



Within nine years, the increase in the average global temperature may exceed 1.5 degrees, forecasts the Intergovernmental Panel on Climate Change (IPCC) under the UN, warning of extreme weather events that all of us have witnessed in recent years. The only way to slow down this trend is to act immediately and for all governments worldwide to assume political responsibility.

Every six years, researchers from around the world assess scientifically significant studies on climate change. In the first part of the Sixth Assessment Report, released this Monday, the **Intergovernmental Panel on Climate Change (IPCC) under the UN*** once again published a forecast for the climatic future – it is even more precise than previous ones, but unfortunately it is shaded in dark tones.

According to the research from the first partial report (the official report will follow), the increase of the average global temperature by 1.5 degrees compared to the pre-industrial era may be reached earlier than assumed only a few years ago. There is a high probability that the warming limit set in the Paris Agreement on climate will be reached at the beginning of the 2030s. In the UN agreement, states committed themselves to keeping global warming compared to the pre-industrial era below two degrees, "if possible" even below 1.5 degrees. Depending on the scenario, 1.5 degrees will be exceeded no later than 2040. The 2018 IPCC Special Report states that 1.5 degrees will be reached between 2030 and 2052 if greenhouse gas emissions do not decrease drastically. However, within just three years the situation has fundamentally changed, and in an irreversible direction at that.

The more accurate the projections, the darker the outlook

"In the previous report a linear increase in temperature was assumed," explains lead IPCC author Jochem Marotzke from the Max Planck Institute for Meteorology. However, this was only a rough estimate. The oceanographer leads the chapter on climate projections. "We now know that the warming curve is likely to rise faster than assumed at that time." The global community will miss the Paris targets if greenhouse gas emissions do not decline rapidly.

In contrast to previous publications of the scientific committee established by the UN, the projections and assessments of the climate models used are now more accurate because more information is generated by supercomputers. "Computational capacity today is much higher than six years ago, there are longer measurement series and numerous new data, which allow a rich set of comparative characteristics of climate change," explains Astrid Kindler-Scharr, also a lead IPCC author. "This enables us to calculate the future of the global climate with great precision."

Extreme weather conditions: increasingly hot, wetter and drier

For the first time, a global climate report also contains a separate chapter on extreme weather conditions. On the basis of the latest in-depth studies describing the contribution of climate change to weather events, it becomes clear that there is an increased frequency of extreme weather conditions such as prolonged droughts or floods with enormous economic and social consequences. Thus, the authors manage to decipher past events such as heat waves in North America or the fires in Australia and to structure a general picture of changes over an extended period of time. Today, climate models are based on concrete and precise assessments of regional meteorological phenomena.

“The report makes it clear that climate change plays a major role in the increased frequency of heatwaves,” says Friederike Otto, author of the chapter on extreme weather conditions and head of the Environmental Change Institute at the University of Oxford. In all parts of the world without exception, the number of very hot days will increase. “With an average warming of four degrees above pre-industrial levels, the global mean temperature will be more than five degrees higher on extremely hot days.”

As temperatures rise, the combination of extreme events also increases: the simultaneous occurrence of heatwaves, droughts, heavy rainfall and storms. “The warmer it becomes around the world, the more we will see extreme events that have never before been so intense and devastating,” warns Friederike Otto. It is crucial whether the world strives for a reduction of 1.5 or 2 degrees compared to the pre-industrial era.

Greenhouse gases are a broad concept

According to the authors of the UN Intergovernmental Panel of Experts on Climate Change, the global target of 1.5 degrees can still be achieved; it depends on how quickly countries respond and seek to reduce their greenhouse gas emissions.

One major hope is the significant reduction of short-lived greenhouse gases. While CO₂ remains in the atmosphere for hundreds of years, other gases contribute to the greenhouse effect for a relatively short period of time. “Therefore, limiting them leads to an effect relatively quickly,” writes Kindler-Scharr, lead author of the chapter on short-lived gases.

For this reason, the report examines different types of gases. Along with trace gases such as carbon dioxide and methane, scientists also focus on the enormous impact of precursor gases (sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds), which arise as a result of various chemical reactions.

The group of short-lived substances that affect the climate also includes aerosols, i.e. small particles such as fine dust from vehicle exhaust gases. Depending on their chemical composition, they can also influence the global climate by warming or cooling the planet.

For example, black carbon, one of the common components of soot, most often found in fine particles (smaller than 2.5 millimetres in

diameter), is the result of incomplete combustion of fuels – both fossil fuels and firewood. In urban areas, emissions

of black carbon are most often due to road transport and in particular diesel engines. In addition to its impact on health, black carbon in particulate matter contributes to climate change by absorbing solar heat and warming the atmosphere.

Insufficient attention is still paid to ozone, which is a special and highly reactive form of oxygen consisting of three oxygen atoms. In the stratosphere – one of the upper layers of the atmosphere – ozone protects us from the Sun's harmful ultraviolet radiation. But in the lowest layer – the troposphere – it is actually an important pollutant that damages public health and nature. Ground-level ozone is formed as a result of complex chemical reactions between precursor gases, such as nitrogen oxides, and non-methane volatile organic compounds. High

ozone concentrations reduce the ability of plants to carry out photosynthesis and hinder the uptake of carbon dioxide. Ozone also impedes plant reproduction and growth, leading to lower agricultural yields and reduced forest growth. Methane and carbon monoxide also play a role in its formation.

"The warming caused by such substances is as high as that from CO₂," says Kindler-Scharr. "Only by drastically reducing these greenhouse gases could we reduce warming by 0.2 degrees by 2040 and by 0.8 degrees by 2100." They do not replace the need to reduce CO₂ emissions, but complement the overall picture of various harmful substances that contribute to climate change.

Of course, methane remains a major source of climate problems, as it contributes about 87 times more to global warming than CO₂. This is due mainly to the extraction and transport of natural gas, as well as to agriculture (livestock farming).

An incentive for UN climate negotiations

"The report is a reality check," comments the co-chair of the first partial report of the Intergovernmental Panel on Climate Change (IPCC) under the UN, Valérie Masson-Delmotte. "As scientists, we do not make any demands on policy," explains lead author Jochem Marotzke. Nevertheless, the results of the report inevitably raise the question of how seriously governments intend to take climate protection issues. "This report clearly shows that if the level of emissions remains high, we will not achieve the 1.5 or two-degree targets of the Paris Agreement," said Marotzke.

Intergovernmental Panel on Climate Change (IPCC) under the UN*

The Intergovernmental Panel on Climate Change (IPCC) is a scientific and intergovernmental body within the structure of the United Nations community, established at the request of the governments of the member states, which seeks to quantify the climate changes that have occurred since the beginning of the 20th century and to present the resulting risks. The Panel places special emphasis on data on global warming. The organization was initially founded in 1988 by two UN bodies – the World Meteorological Organization and the United Nations Environment Programme. The Panel issues reports that support the United Nations Framework Convention on Climate Change, which is the main international treaty related to climate change. The primary goal of the Framework Convention is “to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” The Panel’s reports include “scientific, technical and socio-economic information relevant to understanding the scientific basis of the risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.”

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