Greenhouse gas emissions at 'all-time high' causing unprecedented rate of global warming, warn scientists

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Human-caused global warming has continued to increase at an "unprecedented rate" since the last major assessment of the climate system published two years ago, say 50 leading scientists.

One of the researchers said the analysis was a "timely wake-up call" that the pace and scale of climate action has been insufficient, and it comes as climate experts meet in Bonn to prepare the ground for the major COP28 climate conference in the UAE in December, which will include a stocktake of progress towards keeping global warming to 1.5°C by 2050.

Given the speed at which the global climate system is changing, the scientists argue that policymakers, climate negotiators and civil society groups need to have access to up-to-date and robust scientific evidence on which to base decisions.

The authoritative source of scientific information on the state of the climate is the UN's Intergovernmental Panel on Climate Change (IPCC) but the turnaround time for its major assessments is five or ten years, and that creates an "information gap," particularly when climate indicators are changing rapidly.

In an initiative being led by the University of Leeds, the scientists have developed an open data, open science platform—the Indicators of Global Climate Change and website (https://igcc.earth/). It will update information on key climate indicators every year.

Critical decade for climate change

The Indicators of Global Climate Change Project is being coordinated by Professor Piers Forster, Director of the Priestley Centre for Climate Futures at Leeds. He said, "This is the critical decade for climate change. Decisions made now will have an impact on how much temperatures will

rise and the degree and severity of impacts we will see as a result.

"Long-term warming rates are currently at a long-term high, caused by highest-ever levels of greenhouse gas emissions. But there is evidence that the rate of increase in greenhouse gas emissions has slowed.

"We need to be nimble footed in the face of climate change. We need to change policy and approaches in the light of the latest evidence about the state of the climate system. Time is no longer on our side. Access to up-to-date information is vitally important."

Writing in the journal *Earth System Science Data*, the scientists have revealed how key indicators have changed since the publication of the IPCC's Sixth Assessment Working Group 1 report in 2021, which produced the key data that fed into the subsequent IPCC Sixth Synthesis Report.

What the updated indicators show

- Human-induced warming, largely caused by the burning of fossil fuels, reached an average of 1.14°C for the most recent decade (2013 to 2022) above pre-industrial levels. This is up from 1.07°C between 2010 and 2019.
- Human-induced warming is now increasing at a pace of over 0.2°C per decade.
- The analysis also found that greenhouse gas emissions were "at an all-time high," with human activity resulting in the equivalent of 54 (+/-5.3) gigatons (or billion metric tons) of carbon dioxide being released into the atmosphere on average every year over the last decade (2012-2021).
- There has been positive move away from burning coal, yet this has come at a short-term cost in that it has added to global warming by reducing particulate pollution in the air, which has a

cooling effect.

'Indicators critical to address climate crisis'

Professor Maisa Rojas Corradi, Minister of the Environment in Chile, IPCC author and a scientist involved in this study, said, "An annual update of key indicators of global change is critical in helping the international community and countries to keep the urgency of addressing the climate crisis at the top of the agenda and for evidence-based decision-making.

"In line with the 'ratchet-mechanism' of increasing ambition envisioned by the Paris Agreement we need scientific information about emissions, concentration, and temperature as often as possible to keep international climate negotiations up to date and to be able to adjust and if necessary correct national policies. In the case of Chile, we have a climate change law that aims at aligning government-wide policies with climate action."

Remaining carbon budget

One of the major findings of the analysis is the rate of decline in what is known as the remaining carbon budget, an estimate of how much carbon that can be released into the atmosphere to give a 50% chance of keeping global temperature rise within 1.5°C.

In 2020, the IPCC calculated the remaining carbon budget was around 500 gigatons of carbon dioxide. By the start of 2023, the figure was roughly half that at around 250 gigatons of carbon dioxide.

The reduction in the estimated remaining carbon budget is due to a combination of continued emissions since 2020 and updated estimates of human-induced warming.

Professor Forster said, "Even though we are not yet at 1.5°C warming, the carbon budget will likely be exhausted in only a few years as we have a triple whammy of heating from very high CO_2 emissions, heating from increases in other GHG emissions and heating from reductions in pollution.

"If we don't want to see the 1.5°C goal disappearing in our rearview mirror, the world must work much harder and urgently at bringing emissions down. Our aim is for this project to help the key players urgently make that important work happen with up-to-date and timely data at their fingertips."

Dr. Valérie Masson-Delmotte, from the Université Paris Saclay who co-chaired Working Group 1 of the IPCC's Sixth Assessment report and was involved in the climate indicators project, said, "This robust update shows intensifying heating of our climate driven by human activities. It is a timely wake up call for the 2023 global stocktake of the Paris Agreement—the pace and scale of climate action is not sufficient to limit the escalation of climate-related risks."

As recent IPCC reports have conclusively shown, with every further increment of global warming, that the frequency and intensity of climate extremes—including hot extremes, heavy rainfall and agricultural droughts—increases.

The Indicators of Global Climate Change will have annually updated information on greenhouse gas emissions, human-induced global warming and the remaining carbon budget.

The website extends a successful climate dashboard called the Climate Change Tracker, which was created by software developers who took ideas from the finance industry on how to present complex information to the public.

More information: Piers M. Forster et al, Indicators of Global Climate Change 2022: annual update of large-scale indicators of the state of the climate system and human influence, *Earth System Science Data* (2023). DOI: 10.5194/essd-15-2295-2023

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