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Oceans Heating Faster: IPCC Study

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The ocean is warming much faster than previously thought, new research has found, suggesting that global climate goals may be even harder to reach.

- The study concluded that the global oceans may be absorbing up to 60% more heat since the 1990s than older estimates had found.
- The higher-than-expected amount of heat in the oceans means more heat is being retained within Earth's climate system each year, rather than escaping into space. In essence, more heat in the oceans signals that global warming is more advanced than scientists thought.
- Previous estimates from the U.N. Intergovernmental Panel on Climate Change found that the oceans were taking up around 8 zetajoules of energy each year. (1 Zetajoules= 10^{21} Joules)
 - The new research has put this figure around 13 zetajoules. This suggests that the Earth, as a whole, is more sensitive to climate change than previous estimates, i.e. the planet may respond more strongly to future greenhouse gas emissions than expected.
 - For a perspective, total energy consumption around the world is around half a zetajoule annually, according to the International Energy Agency.
- This may have some grave implications for global efforts to meet the climate targets outlined under the Paris Agreement under which nations are striving to keep global temperatures within 2 degrees Celsius of their pre-industrial levels, or a more ambitious 1.5 degrees Celsius if possible.
- Recently, the IPCC released a report on the 1.5 C threshold, concluding that meeting the target will require an “unprecedented” effort from world leaders and net-zero carbon emissions by 2050.
- The findings suggest if governments are to prevent temperatures from rising above 2 degree Celsius, emissions of carbon dioxide, the chief greenhouse gas produced by human activities, must be reduced by 25 per cent compared to what was previously estimated.

- The new study isn't actually the first to suggest that the IPCC's previous estimates may be too low. In the past few years, other research has also suggested that the oceans may be warming faster—although the exact rate varies from study to study.

Methodology

- Scientists normally measure ocean temperatures using thermometers, but stitching together a global temperature record requires thermometers around the globe.
- But before 2007 or so, ocean floats were much more sparse, and scientists also widely relied on measurements taken by passing ships. That made it a little difficult to estimate ocean changes throughout the world, because these data tended to be concentrated mainly in major shipping routes.
- An international consortium, in 2007 began a program, known as **Argo**, creating an international network of ocean-temperature and salt content measuring instruments.
- Because of the issues with collecting direct ocean data in past decades, the new research attempted to solve the problem without using direct ocean measurements at all. Instead, it relied on measurements of oxygen and carbon dioxide in the atmosphere, dating back to 1991.
 - The oceans absorb more than 90% of the excess energy trapped within the world's atmosphere.
 - There's a strong relationship between ocean heat and the amount of dissolved gas from the atmosphere that oceans can hold. As the ocean warms, its ability to take in oxygen and carbon dioxide decreases and more of those gases remain in the atmosphere.
 - By observing changes in atmospheric oxygen and carbon dioxide levels—controlling for other factors, like human emissions of greenhouse gases—the scientists were able to estimate how the ocean's heat content had changed over the last few decades.
- However, since this is a novel approach, it is unclear if it will hold up to further scrutiny. Also, this methodology works best over long periods of time but does not detail what happens year to year.