Nature can selectively buffer human-caused global warming

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Can naturally occurring processes selectively buffer the full brunt of global warming caused by greenhouse gas emissions resulting from human activities?

Yes, find researchers from the Hebrew University of Jerusalem, Johns Hopkins University in the US and NASA's Goddard Space Flight Center.

As the globe warms, ocean temperatures rise, leading to increased water vapor escaping into the atmosphere. Water vapor is the most important greenhouse gas, and its impact on climate is amplified in the stratosphere.

In a detailed study, the researchers from the three institutions examined the causes of changes in the temperatures and water vapor in the tropical tropopause layer (TTL). The TTL is a critical region of our atmosphere with characteristics of both the troposphere below and the stratosphere above.

The TTL can have significant influences on both atmospheric chemistry and climate, as its temperature determines how much water vapor can enter the stratosphere. Therefore, understanding any changes in the temperature of the TTL and what might be causing them is an important scientific question of significant societal relevance, say the researchers.

The Israeli and US scientists used measurements from satellite observations and output from chemistry-climate models to understand recent temperature trends in the TTL. Temperature measurements show where significant changes have taken place since 1979.

The satellite observations have shown that warming of the tropical Indian Ocean and tropical Western Pacific Ocean – with resulting increased precipitation and water vapor there—causes the opposite effect of cooling in the TTL region above the warming sea surface. Once the TTL cools, less water vapor is present in the TTL and also above in the stratosphere,

Since water vapor is a very strong greenhouse gas, this effect leads to a negative feedback on climate change. That is, the increase in water vapor due to enhanced evaporation from the warming oceans is confined to the near- surface area, while the stratosphere becomes drier. Hence, this effect may actually slightly weaken the more dire forecasted aspects of an increasing warming of our climate, the scientists say.

The researchers are Dr. Chaim Garfinkel of the Fredy and Nadine Herrmann Institute of Earth Sciences at the Hebrew University and formerly of Johns Hopkins University, Dr. D. W. Waugh and Dr. L. Wang of Johns Hopkins, and Dr. L. D. Oman and Dr. M. M. Hurwitz of the Goddard Space Flight Center. Their findings have been published in the *Journal of Geophysical Research: Atmospheres*, and the research was also highlighted in *Nature Climate Change*.

More information: Garfinkel, C. I., D. W. Waugh, L. D. Oman, L. Wang, and M. M. Hurwitz (2013), Temperature trends in the tropical upper troposphere and lower stratosphere: Connections with sea surface temperatures and implications for water vapor and ozone, *J. Geophys. Res. Atmos.*, 118, 9658–9672, DOI: 10.1002/jgrd.50772.

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