Press Release

GEOMAR
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Further research on climate change in the tropical Pacific needed

New GEOMAR study reports climate simulations to deviate from actual developments in the tropical Pacific and their significance for projections of the future climate

***19.07.2023/Kiel*. Computer models simulate how the Earth's climate has changed under the influence of increasing greenhouse gas concentrations and how it will develop in the future. A study by GEOMAR Helmholtz Centre for Ocean Research Kiel now published in the journal *Nature Communications Earth & Environment* shows that the models simulate trends during the last decades in the tropical Pacific that are partly inconsistent with observations. A more accurate representation of the climate dynamics in the region is of high importance for robust projections of the future climate.**

In recent months, average temperatures at the sea surface have been higher than any time since the start of satellite measurements about 40 years ago. Global warming caused by human emissions of greenhouse gases - especially carbon dioxide (CO_2) - is mainly responsible for the steady rise in ocean temperatures, which is confirmed by climate models. However, there are striking differences between ocean regions: Some have warmed particularly strongly, others have even cooled slightly. In a study now published in the journal *Nature Communications Earth & Environment*, a team of researchers from the research units Marine Meteorology and Physical Oceanography at GEOMAR Helmholtz Centre for Ocean Research Kiel reports that, in contrast to historical model simulations, parts of the tropical Pacific have warmed less than the global average or even cooled slightly during the past decades. According to the researchers, this proves that an improved understanding of climate dynamics in the tropical Pacific region is necessary for a more reliable prediction of future changes in the climate.

“We need an even more precise understanding of small-scale processes in the climate system”, emphasises Professor Dr. Mojib Latif, lead author of the study. “The reasons for the differences between the model simulations and the actual development in the tropical Pacific are not yet understood. We now need to clarify the mechanisms behind the cooling trend and extend the models accordingly to further strengthen the robustness of future regional climate projections.”

The study provides reasons for the unexpected temperature development in the tropical Pacific. For example, the researchers document stronger trade winds above the region over the past four decades. This strengthening has counteracted the temperature increase in the region caused by greenhouse gases – both through dynamic processes in the ocean as well as the heat exchange between air and sea. Current climate models have not yet been able to reproduce the observed trends in atmospheric circulation.

“The tropical Pacific is a key region for climate change. This is illustrated by the El Niño climate phenomenon currently developing in the tropical Pacific and its impacts on the global weather. Climate models have correctly predicted the El Niño event several months in advance – as well as the long-term human-induced global temperature development of the past decades”, explains Professor Dr. Latif. “Nevertheless, we cannot rest on the successes of the past years: The analyses presented in our study support the assumption that a higher model resolution, in combination with

the inclusion of previously unresolved small-scale processes, can be an important step towards making climate models even more accurate on the regional scale."

On the one hand, this requires significantly greater computer capacities, on the other, an even closer link between the models and the measurements. But despite some regional deviations between the models and the observations, it is clear that global warming will continue unabated if atmospheric greenhouse gas concentrations continue to rise.

Original publication:
Latif, M., Bayr, T., Kjellsson, J. et al. (2023): Strengthening atmospheric circulation and trade winds slowed tropical Pacific surface warming. Nature Communications Earth & Environment, doi: https://doi.org/10.1038/s43247-023-00912-4

Links:
https://www.geomar.de/en/discover/ocean-and-climate/model-simulations GEOMAR Discover: How Model Simulations Help to Better Understand Our Climate System

Images:
Images are available for download at http://www.geomar.de/n9039-e

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