

Recent climate extremes have driven unprecedented changes in the deep ocean

November 16 2020



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New measurements reveal a surprising increase in the amount of dense water sinking near Antarctica, following 50 years of decline.

Dense water formed near Antarctica, known as Antarctic Bottom Water, supplies oxygen to the [deep ocean](#). Bottom water also forms part of the global network of [ocean](#) currents that influences [climate](#) by storing heat and carbon dioxide in the ocean. Changes in bottom water formation can therefore impact [global climate](#) and deep ocean ecosystems.

The study, led by Dr. Alessandro Silvano from the University of Southampton and CSIRO and published in the journal *Nature Geoscience*, documents an increase in the supply of bottom water to the deep Indian and Pacific Oceans. "Over the past 50 years of oceanographic campaigns we have seen a reduction in the amount of dense water reaching the deep ocean," Dr. Silvano said. "This trend was mysteriously interrupted in 2018."

The research found that unusual wind patterns near Antarctica changed [ocean currents](#) in the Ross Sea where bottom water is formed. The changes in wind and currents increased the amount of ocean cooling and freezing. The extra cooling and freezing, in turn, increased the density of water that sinks into the deep ocean, producing additional dense bottom water.

"We found that an unusual combination of two climate phenomena drove the renewal of bottom water formation: an extreme El Niño event occurring at the same time as stronger and southward-shifted westerly winds," said Dr. Silvano. "These results show how remote forcing can influence Antarctic processes and climate."

Co-author Annie Foppert, from the Australian Antarctic Program Partnership and CSIRO's Centre for Southern Hemisphere Oceans Research, said, "Evidence suggests the gradual decline in bottom water formation over the past five decades probably resulted from increased melt of the Antarctic Ice Sheet. The surprising rebound in recent years shows how extreme climate events can temporarily reverse long-term

trends in Antarctic climate."

"In the future, we expect the accelerating melt of the Antarctic Ice Sheet to reduce the formation of bottom water" said Dr. Silvano. "But climate extremes like those that drove the recent rebound in bottom water formation are also projected to become more common if [greenhouse gas emission](#) by human activities continue at current rates."

"Further work is needed to understand how these competing factors will affect bottom [water](#) formation in a warming climate."

More information: Recent recovery of Antarctic Bottom Water formation in the Ross Sea driven by climate anomalies, *Nature Geoscience* (2020). [DOI: 10.1038/s41561-020-00655-3](https://doi.org/10.1038/s41561-020-00655-3) , www.nature.com/articles/s41561-020-00655-3

Provided by CSIRO

Citation: Recent climate extremes have driven unprecedented changes in the deep ocean (2020, November 16) retrieved 24 May 2024 from <https://phys.org/news/2020-11-climate-extremes-driven-unprecedented-deep.html>

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