

Southern Ocean resistant to changing winds

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Intensifying winds in the Southern Ocean have had little influence on the strength of the Southern Ocean circulation and therefore its ability to absorb carbon dioxide from the atmosphere, according to a study published in *Nature Geoscience*.

The Southern Ocean slows the rate of greenhouse warming by removing carbon dioxide from the atmosphere and storing it in the ocean. But previous studies raised the alarm by suggesting the Southern Ocean carbon sink is now 'saturated' and no longer able to keep pace with increasing concentrations of carbon dioxide in the atmosphere.

The new study suggests that Southern Ocean currents, and therefore the Southern Ocean's ability to soak up carbon dioxide, have not changed in recent decades, despite a large increase in winds.

A team of German and Australian scientists compared new ocean measurements from a global network of ocean robots with historical data from ships to determine if the Southern Ocean was changing. The study was led by Professor Claus Böning from the Institute of Marine Research (IFM-GEOMAR), Kiel.

Co-author, CSIRO's Dr Steve Rintoul, says the Southern Ocean was found to have become warmer and fresher since the 1960s – a pattern consistent with the 'fingerprint' of climate change caused by carbon emissions from human activity.

"But, counter to our expectations, other aspects of the Southern Ocean

have not changed despite the increase in winds," he says. "In particular, we found no evidence of a change in strength of the ocean currents that circle around Antarctica, or in the amount of deep water rising to the surface near Antarctica."

The fact that the upwelling of deep water has not changed is important. Deep water is very rich in carbon dioxide and so an increase in upwelling tends to transfer carbon dioxide from the ocean to the atmosphere. The low-resolution models used for climate forecasts predict stronger winds, which cause stronger upwelling and therefore less carbon dioxide being stored in the ocean.

"Our results suggest that the small-scale motions of ocean eddies act to balance the stronger winds, with no change in upwelling," Dr Rintoul says. "Climate models in use today cannot represent these small-scale motions and so over-estimate the response of the Southern Ocean to changes in winds." Dr Rintoul works through the Antarctic Climate and Ecosystem Cooperative Research Centre (ACECRC) and CSIRO's Wealth from Oceans Flagship.

Integral to the research was the Australian ocean data archive and the Argo network of ocean profilers. The data provided by the global array of more than 3,100 Argo floats is particularly valuable in remote areas like the sparsely-sampled Southern Ocean.

Source: CSIRO Australia

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