

Dwindling buffer effect?

March 28 2013, by Peter Rüegg



Credit: AI-generated image ([disclaimer](#))

(Phys.org) —The Southern Ocean could absorb relatively less carbon dioxide in future if the global temperatures continue to rise as a result of human activities, as climate researchers from ETH Zurich demonstrate based on an analysis of two sediment drill cores from the Atlantic sector of the Southern Ocean. The study has just been published in the journal *Science*.

Oceans, especially the cold regions around the poles, act as CO₂ buffers: they have absorbed around half of anthropogenic [CO₂ emissions](#). However, there is mounting evidence that this buffer capacity is dwindling. In order to find out whether the Southern Ocean might absorb less CO₂ in future, ETH-Zurich researchers studied the [biological productivity](#) of these waters during the last million years based on sediment [drill cores](#).

Strong winds churn up deep waters

During this time, cold and warm phases alternated periodically. At the beginning of a warm period, the global temperature rose, which is why the sub-Antarctic wind belt – the Roaring Forties – drifted south, closer to the Antarctic. The strong winds churned up the seawater and deep waters rose to the surface, releasing the CO₂ they had been sequestering back into the atmosphere. Moreover, the deep water transported nutrients upwards, which stimulated the growth of algae and plankton. In the transition from a warm period to a cold one, however, these gigantic circulator pumps were switched off, CO₂ was "stored" in the deep water and biological activity fell sharply.

"Based on the reconstruction of the productivity of the Southern Ocean, we can prove that the [CO₂ concentration](#) in the atmosphere and the upwelling intensity of the deep water are linked," says first author on the study Samuel Jaccard from ETH Zurich's Geological Institute. The colder it is on Earth, the less the deep water rises and therefore the more CO₂ "sinks" in the sea.

Based on their findings, Jaccard estimates that the Southern Ocean will be stirred up more intensely in future due to the increasing [global temperatures](#), which means more CO₂ will get into the atmosphere or remain there and increase the rise in temperature. As a result, the buffer capacity of the southern polar seas should decline.

More information: Jaccard, S. et al. Two modes of change in southern ocean productivity over the past million years. *Science*, 22 March 2013: 1419-1423. [DOI:10.1126/science.1227545](https://doi.org/10.1126/science.1227545)

Provided by ETH Zurich

Citation: Dwindling buffer effect? (2013, March 28) retrieved 27 April 2024 from <https://phys.org/news/2013-03-dwindling-buffer-effect.html>

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