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Future CO2 uptake and storage in the world ocean

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The ocean plays a major role in the carbon cycle, and accurately determining the oceanic uptake and storage of carbon is essential for long-term predictions of anthropogenic climate change. Improvements in ocean physics have recently been identified as a key factor in improving the somewhat varying predictions of the ocean carbon cycle produced by previous modelling studies.

Taking advantage of recent model developments at the Max Planck Institute for Meteorology, we thus run the HAMOCC ocean carbon cycle model forced with ocean physics fields taken from a number of state-of-the-art coupled ocean-atmosphere GCM integrations. Data from new IPCC runs are used to predict possible future distributions of ocean carbon uptake and storage under a variety of CO2 emissions scenarios. Preliminary results from a less complex version of the model confirm the possibility of the North Atlantic becoming a source, rather than a sink, of anthropogenic CO2.

Data is also taken from coupled runs where the thermohaline circulation in the North Atlantic is artificially supressed by the addition of freshwater at high latitudes. Previous modelling studies suggest the importance of the ventilation of deep waters in driving CO2 uptake in the ocean; our experiments help to isolate what effect any future slowdown of the thermohaline circulation might have on the ocean carbon budget as both the deep water formation rates and the ocean circulation patterns change.