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Eddy saturation and ocean heat uptake in a climate model with an eddy-permitting ocean

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The reaction of the Southern Ocean to climate change is not well understood. While atmospheric observations clearly show a strengthening of the westerlies, the response of the oceanic circulation varies strongly across the IPCC AR4 climate models. In addition, high-resolution ocean models suggest that those climate models do not capture a crucial effect. The oceanic mesoscale eddy field seems to be able to take up much of the additional wind stress such that the there is no increased oceanic upwelling in response to the accelerated winds. We study this effect, called eddy saturation, in HiGEM1.2, a fully coupled GCM with a 1/3^{o} resolution, eddy-permitting ocean, where the mesoscale eddy field does not need to be parameterized. Our focus is on ocean heat uptake, for which the Southern Ocean is a crucial region. Specifically, we analysed in an enhanced-wind and an increased-CO2 run the impact on the uptake and the interior transport of heat. For this purpose we use detailed diagnostics of the individual terms in the tracer advection.