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Ocean warming and accelerating Southern Ocean zonal flow

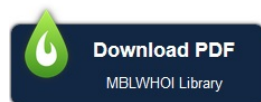
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Abstract

The Southern Ocean (>30° S) has taken up a large amount of anthropogenic heat north of the Subantarctic Front (SAF) of the Antarctic Circumpolar Current (ACC). Poor sampling before the 1990s and decadal variability have heretofore masked the ocean’s dynamic response to this warming. Here we use the lengthening satellite altimetry and Argo float records to show robust acceleration of zonally averaged Southern Ocean zonal flow at 48° S–58° S. This acceleration is reproduced in a hierarchy of climate models, including an ocean-eddy-resolving model. Anthropogenic ocean warming is the dominant driver, as large (small) heat gain in the downwelling (upwelling) regime north (south) of the SAF causes zonal acceleration on the northern flank of the ACC and adjacent subtropics due to increased baroclinicity; strengthened wind stress is of secondary importance. In Drake Passage, little warming occurs and the SAF velocity remains largely unchanged. Continued ocean warming



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