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Response of the Antarctic Circumplar Current to recent climate change

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Observations indicate a significant intensification of the Southern Hemisphere westerlies during the last decades. A continuation of this trend is projected by climate scenarios for the 21st century. The response of the Antarctic Circumpolar Current (ACC) and Southern Ocean carbon sink to changes in wind stress and surface buoyancy fluxes is under debate. Here we utilize the Argo network of profiling floats and historical data to assess the changes in temperature, salinity and density across the ACC during the last four decades. We find coherent hemispheric-scale warming and freshening trends extending to depths of more than 1000m. The trends are partly related to changes in water mass properties, consistent with the effect of anthropogenic changes in heat and freshwater fluxes suggested by climate models. However, there is no increase in the tilt of density surfaces across the ACC, in contrast to coarse-resolution model studies. The result implies ACC transport and meridional overturning – and therefore the Southern Ocean carbon sink – are insensitive to decadal changes in wind stress, suggesting wind-driven Ekman transport is compensated by eddy fluxes, as simulated by models with explicit eddies.