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# The physical transport of anthropogenic carbon into the Southern Ocean interior

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The oceans slow the rate of climate change by absorbing about 25% of the annual $CO_2$ emissions due to human activities. The Southern
Ocean makes a substantial contribution to this oceanic sink: more than
40% of the global oceanic inventory of anthropogenic $CO_2$ has entered the ocean south of 40S. The rate-limiting step in ocean sequestration of anthropogenic $CO_2$ is the transfer of carbon across the base of the surface mixed layer into the ocean interior. However, the physical mechanisms responsible for the subduction of anthropogenic $CO_2$ are poorly known.
Here we use observations to show that the subduction occurs in specific locations where wind-driven Ekman transport, eddy fluxes and variations in mixed layer depth along mean streamlines drive anthropogenic carbon across the mixed-layer base. The net subduction is 0.42 +/- 0.2 Pg C/y between 35S and the marginal sea-ice zone. Both the magnitude and location of the inferred transport are consistent with the observed interior distribution of anthropogenic carbon. These results highlight the dependence of ocean carbon sequestration on physical properties likely to be sensitive to climate variability and change, including mixed layer depth, ocean currents, wind and eddies.