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# Saturation of the Southern ocean $CO_2$ sink due to recent climate change

**C. Le Quéré** (1,2), C. Rödenbeck (3), E. T. Buitenhuis (1), T. J. Conway (4), R. Langenfelds (5), A. Gomez (6), C. Labuschagne (7), M. Ramonet (8), T. Nakazawa (9), N. Metzl (10), N. Gillett (11), and M. Heimann (3)

(1) School of Environmental Sciences, University of East Anglia, Norwich, UK, (2) British Antarctic Survey, High Cross, Madingley Road, Cambridge, UK, (3) Max Planck Institut für Biogeochemie, Jena, Germany, (4) National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Boulder, USA, (5) Commonwealth Scientific and Industrial Research Organisation, Marine and Atmospheric Research, Aspendale, Australia, (6) National Institute for Water and Atmospheric Research, Wellington, New Zealand, (7) South African Weather Service, Stellenbosch, South Africa, (8) Laboratoire des Sciences du Climat et de l'Environnement/Institut Pierre Simon Laplace (LSCE/IPSL), Gif-sur-Yvettes, France, (9) Center for Atmospheric and Oceanic Studies, Tohoku University, Sendai, Japan, (10) Laboratoire d'Océanographie et du Climat: Expérimentation et Approches Numériques (LOCEAN/IPSL), CNRS, Université Pierre and Marie Curie, Paris, France, (11) Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, UK.

Based on observed atmospheric $CO_2$ concentration and an inverse method, we estimate that the Southern Ocean sink of $CO_2$ has weakened between 1981 and 2004 by 0.08 PgC/y per decade relative to the trend expected from the large increase in atmospheric $CO_2$. Results from an ocean biogeochemistry model forced by atmospheric surface conditions from re-analysis data suggest that the Southern Ocean weakening is caused by the observed increase in Southern Ocean winds resulting from the depletion of stratospheric ozone and from global warming. Climate models project that the increase in Southern Ocean winds will persist in the future. We estimate that the consequences of future increases in winds include a reduction of the efficiency of the Southern Ocean sink of $CO_2$ in the short term ($\sim$25 years) and possibly a higher level of stabilization of atmospheric $CO_2$ on a multi-century time-scale.