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Inter-annual variability of the carbon dioxide oceanic sink south of Tasmania

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We compiled a large data-set from 22 cruises spanning from 1991 to 2003, of the partial pressure of CO2 (pCO2) in surface waters over the continental shelf (CS) and adjacent open ocean (43° to 46°S; 145° to 150°E), south of Tasmania. Sea surface temperature (SST) anomalies (as intense as 2°C) are apparent in the subtropical zone (STZ) and subAntarctic zone (SAZ). These SST anomalies also occur on the CS, and seem to be related to large-scale coupled atmosphere-ocean oscillations. Anomalies of pCO2 normalized to a constant temperature are negatively related to SST anomalies. A depressed winter-time vertical input of dissolved inorganic carbon (DIC) during phases of positive SST anomalies, related to a poleward shift of westerly winds, and a concomitant local decrease in wind stress are the likely cause of the negative relationship between pCO2 and SST anomalies. The observed trend is an increase of the sink for atmospheric CO2 associated with positive SST anomalies, although strongly modulated by inter-annual variability of wind speed. Assuming that phases of positive SST anomalies are indicative of the future evolution of regional ocean biogeochemistry under global warming, we show using a purely observational based approach that some provinces of the Southern Ocean could provide a potential negative feedback on increasing atmospheric CO2.