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Satellite Observations Reveal High Variability and a Decadal Trend in CO_2 fluxes on the Scotian Shelf

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The rise in atmospheric CO_2, due to anthropogenic emissions, is partially offset by the ocean's CO_2 uptake. Direct measurements of surface-ocean CO_2 partial pressure (pCO_2) are required to accurately assess the seasonal and interannual variability of air-sea CO_2 fluxes. The coastal oceans have relatively large fluxes of CO_2, but the temporal variability of these systems is high. Compared to open ocean systems, the variability of pCO_2 in coastal regions remains poorly understood. We develop an algorithm to compute pCO_2 in the Scotian Shelf region (NW Atlantic) from satellite-based estimates of chlorophyll-a concentration, sea-surface temperature, and wind speed. This algorithm is based on a high-resolution time-series of pCO_2 observations from an autonomous mooring. A hindcast of air-sea CO_2 fluxes from 1999 to 2008 reveals significant variability both spatially and from year to year. Regional conditions govern spatial and interannual variability on the Scotian Shelf, while multi-annual trends appear to be correlated with the North Atlantic Oscillation.