Satellite Observations Reveal High Variability and a Decadal Trend in CO₂ fluxes on the Scotian Shelf

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The rise in atmospheric CO₂, due to anthropogenic emissions, is partially offset by the ocean’s CO₂ uptake. Direct measurements of surface-ocean CO₂ partial pressure (pCO₂) are required to accurately assess the seasonal and interannual variability of air-sea CO₂ fluxes. The coastal oceans have relatively large fluxes of CO₂, but the temporal variability of these systems is high. Compared to open ocean systems, the variability of pCO₂ in coastal regions remains poorly understood. We develop an algorithm to compute pCO₂ 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 pCO₂ observations from an autonomous mooring. A hindcast of air-sea CO₂ 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.