

The Changing North Atlantic Carbon Cycle: 1992-2006

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Observations and models suggest substantial changes in the ocean carbon sink over the past two decades in the Southern Ocean (LeQuere et al., 2007), North Atlantic (Schuster and Watson, 2007), North Pacific (Takahashi et al., 2006) and equatorial Pacific (Feely et al. 2006). The changes appear to make significant contributions to the increasing retention of anthropogenic CO₂ emission in the atmospheric reservoir (Canadell et al. 2007). Other important trends have also been observed: for example, satellite ocean color observations suggest declining biological productivity in permanently stratified regions (Behrenfeld et al., 2006),

This talk will focus on elucidating mechanistic relationships between climate forcing and carbon cycle variability in the North Atlantic using an ocean biogeochemical model. The model is used to assess the impact of climate variability in recent decades on biological productivity, surface ocean pCO₂, and air-sea CO₂ fluxes. In the subpolar gyre, the model suggests there is little year-to-year variability or long-term trends in biological productivity and biologically-mediated export of carbon to the deep ocean. Yet, across the basin, the model suggests substantial changes in the magnitude of the carbon sink throughout the basin. Changing North Atlantic forcing and circulation sets the spatial pattern of the trend, while rising atmospheric pCO₂ drives the net increase in the CO₂ sink over time. Modeled changes are consistent with recent analyses of in situ pCO₂ data.

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