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Biogeochemical Trends and Their Ecosystem Impacts in Atlantic Canada

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The representation of coastal oceans in global biogeochemical models is a challenge, yet the ecosystems in these regions are most vulnerable to the combined stressors of ocean warming, deoxygenation, acidification, eutrophication and fishing. Coastal regions also have large air-sea fluxes of CO_2, making them an important but poorly quantified component of the global carbon cycle, and are the most relevant for human activities. Regional model applications that are nested within large-scale or global models are necessary for detailed studies of coastal regions. We present results from such a regional biogeochemical model for the northwestern North Atlantic shelves and adjacent deep ocean of Atlantic Canada. The model is an implementation of the Regional Ocean Modeling System (ROMS) and includes an NPZD-type nitrogen cycle model with explicit representation of dissolved oxygen and inorganic carbon. The region is at the confluence of the Gulf Stream and Labrador Current making it highly dynamic, a challenge for analysis and prediction, and prone to large changes. Historically a rich fishing ground, coastal ecosystems in Atlantic Canada have undergone dramatic changes including the collapse of several economically important fish stocks and the listing of many species as threatened or endangered. Furthermore it is unclear whether the region is a net source or sink of atmospheric CO_2 with estimates of the size and direction of the net air-sea CO_2 flux remaining controversial. We will discuss simulated patterns of primary production, inorganic carbon fluxes and oxygen trends in the context of circulation features and shelf residence times for the present ocean state and present future projections.