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Modeling basin-scale pCO2 temporal and spatial variability in the North Atlantic Ocean

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Numerical models have been employed in understanding and capturing real-time spatiotemporal CO2 trends, interseasonal to decadal variability, and the characterization of thermal (pCO2-T) and nonthermal (pCO2-nonT) components of surface ocean pCO2 and air-sea CO2 fluxes. We employed MITgcm and newly available data from two North Atlantic time series observatories to capture in situ pCO2 observations and deconvolute bio-physical controlling processes. The model suggests that pCO2 cycle is marked by summertime minimum and wintertime maximum. The physical-chemical and biological response pattern of the model is in good accordance with the observed pCO2, pCO2-T and pCO2-nonT trends. Model outputs suggest that CO2 cycle is governed by contrasting effects of seasonal cooling and warming, spring and summer biology activities. It also predicts year-round undersaturation, indicating that the region is a moderate to weak sink of CO2.