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Predictability of estuarine model using Information Theory: ROMS Ocean State Ocean Model

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With a focus on modelling physical aspects of estuaries covering Rhode Island, USA, the Ocean State Ocean Model (OSOM) has been implemented using the Regional Ocean Modeling System. The estuary includes Narragansett Bay, Mt. Hope Bay, and nearby regions including the shelf circulation from Long Island to Nantucket. Our goal is to find predictability and estuarine time scales in order to build a forecasting system

Perturbed ensemble simulations with altered initial condition parameters (temperature, salinity) are combined with concepts from Information Theory to quantify the predictability of the OSOM forecast system. Predictability provides a theoretical estimate of the potential forecasting capabilities of the model in the form of prediction time scales and enhances readily estimable timescales such as the freshwater/ saline water flushing timescale. The predictability of the OSOM model is around 10-40 days, varying by perturbation parameters and season. Internal variability is low when compared to forced variability for the current resolution of OSOM suggesting modest chaos at this resolution.

Freshwater flushing time scale and total exchange flow was calculated for the OSOM model. The freshwater flushing time scale was found to be ~20 days and varies with the choice of the estuary boundary. The predictability time scales and flushing time scales reveal important dynamics of the tracers involved and elucidate their role in driving the estuary.