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Influence of model resolution on local dynamics and circulation in the Baltic Sea.

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Results from two models of the Baltic Sea configured at 1/12° (˜9 km) and 1/48° (˜2.3 km) are analyzed to determine and quantify improvements from quadrupling model horizontal resolution. Both model configurations consist of a regional adaptation of the Parallel Ocean Program (POP) developed at the Los Alamos National Laboratory and coupled to a parallel version of the original Hibler dynamic-thermodynamic model with a viscous-plastic rheology. Each model was forced using the same daily-averaged reanalyzed atmospheric data derived from the European Centre for Medium-range Weather Forecast and interpolated to the respective model grid.

Comparison of results quantifies improvements obtained from four-folding model horizontal resolution. We note that at 2.3-km resolution our model is eddy-resolving as the first baroclinic radius of deformation (Rossby radius), representing the basic dynamical scale, is estimated at 5-7 km in the Baltic Sea (Fennel et al., 1991). We focus on the model reproduction of the local dynamics, currents and large scale circulation, which are of relevance to the entire Baltic Sea system. The salinity and temperature distributions in both models are compared. Gains from better representation of the highly variable bottom topography and land geometry are emphasized. In addition, improvements in simulating eddies, narrow boundary currents, and flow and volume transports through channels and straits are discussed. An increase in eddy kinetic energy is documented. Some eddies appear only in the fine resolution model. Boundary currents are simulated more realistically and mass transports in narrow straits are closer to estimates from observations.