Implementation of turbulence and sediment transport models in MPAS-Ocean

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Accurate simulations of estuarine mixing and material transport such as sediment are essential in understanding the coupled land-river-ocean processes in the coastal environment. This work implements the general ocean turbulence model (GOTM) and a hybrid sediment transport model into MPAS-Ocean, which delivers the model the capability of simulating key estuarine processes across the land-river-ocean interface. The present implementation of the KPP turbulence model in MPAS-Ocean is not suitable for simulating turbulent mixing in the estuarine environment. GOTM brings in a set of state-of-the-art two equation turbulence models that are widely used in regional ocean models for the coastal regions. The hybrid sediment transport model combines the physics-based equations widely used in community models (e.g., COAWST) and the data-based empirical formulae to compute the two main sediment transport components (bedload and suspended sediment transport) as well as the bathymetric change in an estuary. The model will also be capable of simulating the effects of bed slope on sediment transport, effects of sediment density on ocean dynamics and long-term morphological evolution. Recent progress on this model development and some preliminary results will be presented.