A tale of two models: Intercomparison of Bering Sea simulations from structured- (ROMS) and unstructured-(SCHISM) grid models

Regional ocean circulation models often follow different paths in their development. A model that is initially developed to represent estuarine-ocean exchange will likely capture some processes better and some worse than one developed for wind-driven coastal upwelling. While each model has its strengths, the impetus exists to develop the broad applicability of one or the other in the interest of consolidation. Here, two models are compared in simulations of the Bering Sea to help determine the degree to which the models are redundant. The Regional Ocean Modeling System (ROMS) is a more 'traditional' structured-grid finite-volume model that has been used broadly in the coastal ocean modeling community for 20+ years. The Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) is an unstructured-grid finite-element/finite-volume model that has found applicability in cross-scale modeling such as river-estuary-shelf systems. The Bering Sea presents numerous ocean modeling challenges. The coastal regions of the sea vary from a broad shallow eastern shelf (bordering Alaska and Chukotka) with a steep slope transition to the Aleutian Basin, a narrower western (Kamchatkan) shelf and an island arc with associated deep trench (the Aleutian trench) to the south. The northern latitude of the sea not only demands high horizontal model resolution to capture mesoscale features but also requires coupling with a sea ice model as sea ice plays a critical role in the evolution of shelf stratification and ecology. Strong tides (both external and internal), large river runoff and severe weather also contribute to the variability. For this presentation we focus on comparing the representation in the two models of four processes. These are: 1) the seasonal variability in the Bering Slope Current, 2) the coastal sea level in response to storm events, 3) the evolution of shelf stratification resulting from winter sea ice production and melt, and 4) the tidal mixing and currents associated with the eastern Aleutian Island Passes. Additionally we assess the technical challenges associated with application of each model to this region and analyze the computational efficiency of each approach.

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