Applications of the Generalized Vertical Coordinate Ocean Model for Better Representing Satellite Sensing Data

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It is found that two adaptive parametric functions can be introduced into the ocean basic equations for utilizing the optimal or hybrid features of commonly-used z-level, terrain-following, isopycnal, and pressure coordinates in numerical ocean models. The two parametric functions are formulated by combining three techniques: the arbitrary vertical coordinate system of Kasahara (1974), the Jacobian pressure gradient formulation of Song (1998), and a newly developed metric factor that permits both Boussinesq (conserve volume) and non-Boussinesq (conserve mass) approximations. Based on the new formulation, an adaptive modeling strategy is proposed and a staggered finite volume method is designed to ensure conservation of important physical properties and numerical accuracy.

Implementation of the proposed techniques to SCRUM (Song and Haidvogel 1994) shows that the adaptive modeling strategy can be applied to any existing ocean model without incurring computational expense and altering the original numerical schemes. Such a generalized coordinate model is expected to benefit diverse ocean modelers for easily choosing optimal vertical structures and sharing modeling resources based on a common model platform. Several representing oceanographic problems with different scales and characteristics, such as coastal canyon, basin-scale circulation, and global ocean circulation, are used to demonstrate the model's capability for multiple applications. New results show that the model is capable of simultaneously resolving both Boussinesq and non-Boussinesq, and both small- and large-scale processes well.

This talk will focus on its applications of multiple satellite sensing data in eddy-resolving simulations of Asian Marginal Sea and Kurosio. Attention will be given to how Topex/Poseidon SSH, TRMM SST, and GRACE ocean bottom pressure can be correctly represented in a non-Boussinesq model.