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Assessing uncertainty in the turbulent upper-ocean mixed layer using an unstructured finite-element solver LUZ PACHECO, Oregon State University, KATHERINE SMITH, PETER HAMLINGTON, University of Colorado Boulder, KYLE NIEMEYER, Oregon State University — Vertical transport flux in the ocean upper mixed layer has recently been attributed to submesoscale currents, which occur at scales on the order of kilometers in the horizontal direction. These phenomena, which include fronts and mixed-layer instabilities, have been of particular interest due to the effect of turbulent mixing on nutrient transport, facilitating phytoplankton blooms. We study these phenomena using a non-hydrostatic, large eddy simulation for submesoscale currents in the ocean, developed using the extensible, open-source finite element platform FEniCs. Our model solves the standard Boussinesq Euler equations in variational form using the finite element method. FEniCs enables the use of parallel computing on modern systems for efficient computing time, and is suitable for unstructured grids where irregular topography can be considered in the future. The solver will be verified against the well-established NCAR-LES model and validated against observational data. For the verification with NCAR-LES, the velocity, pressure, and buoyancy fields are compared through a surface-wind-driven, open-ocean case. We use this model to study the impacts of uncertainties in the model parameters, such as near-surface buoyancy flux and secondary circulation, and discuss implications.

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