Abstract Submitted
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Turbulent mass flux closure modeling for variable density turbulence in the wake of an air-entraining transom stern[1] KELLI HENDRICKSON, DICK YUE, Massachusetts Institute of Technology — This work presents the development and *a priori* testing of closure models for the incompressible highly-variable density turbulent (IHVDT) flow in the near wake region of a transom stern. This complex, three-dimensional flow includes three regions with distinctly different flow behavior: (i) the convergent corner waves that originate from the body and collide on the ship center plane; (ii) the "rooster tail" that forms from the collision; and (iii) the diverging wave train. The characteristics of these regions involve violent free-surface flows and breaking waves with significant turbulent mass flux (TMF) at Atwood number $At = (\rho_2 - \rho_1)/(\rho_2 + \rho_1) \approx 1$ for which there is little guidance in turbulence closure modeling for the momentum and scalar transport along the wake. Utilizing datasets from high-resolution simulations of the near wake of a canonical three-dimensional transom stern using conservative Volume-of-Fluid (cVOF), implicit Large Eddy Simulation (iLES), and Boundary Data Immersion Method (BDIM), we develop explicit algebraic turbulent mass flux closure models that incorporate the most relevant physical processes. Performance of these models in predicting the turbulent mass flux in all three regions of the wake will be presented.

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