Abstract Submitted
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High Reynolds number effects on a localized stratified turbulent flow[1] QI ZHOU, University of Cambridge, PETER DIAMESSIS, Cornell University — We report large-eddy simulations (LES) of the turbulent flow behind a sphere of diameter D translating at speed U in a linearly stratified Boussinesq fluid with buoyancy frequency N. These simulations are performed using a spectral-multidomain-penalty incompressible Navier-Stokes solver, at Reynolds numbers $Re \equiv UD/\nu \in \{5 \times 10^3,\ 10^5, 4 \times 10^5\}$ and Froude numbers $Fr \equiv 2U/(ND) \in \{4, 16, 64\}$. An increasingly richer turbulent fine-structure is observed within the larger-scale quasi-horizontal vortices at later times. Turbulent transport of momentum is examined during the non-equilibrium (NEQ) regime of the turbulent life cycle, with an emphasis on the vertical transport that occurs after the establishment of local buoyancy control. The turbulent viscosities in both horizontal and vertical directions are estimated through the LES data; possible parameterization of the vertical turbulent viscosity with the buoyancy Reynolds number $Re_b = \varepsilon/(\nu N^2)$ (or its easy-to-obtain surrogates) is discussed. The dynamical role of the buoyancy Reynolds number in choosing the vertical turbulence length scales is also investigated.

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