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Dynamics of Decaying Turbulence in Stably Stratified Flows
DAVID HEBERT, STEPHEN DE BRUYN KOPS, University of Massachusetts Amherst, Amherst, MA — In natural settings it is common for flows with a large initial Froude number to form and subsequently decay from the lack of an energy source. As the flow decays the Froude number will become order 1 and the effects of density stratification become important. If the Reynolds number is sufficiently high the flow will become both turbulent and strongly stratified. In this talk, simulated turbulent flows subject to strong stratification are analyzed from high resolution direct numerical simulations (DNS) generated from two different initial conditions: 1) Taylor-Green vorticies and 2) an idealized momentumless wake. Based on an autocorrelation length scale, the Froude number of the simulations ranged from 1.2-3.4, while the Reynolds number ranged from 15000-38000. When using DNS one has the ability to quantify each term in the kinetic and potential energy transport equations. For the simulated flows in this study, the terms describing the amount of energy converted from kinetic to available potential energy via buoyancy flux, the amount of energy converted between the horizontal and vertical contributions to kinetic energy, and the amount of energy dissipated to heat, ϵ, and to background potential energy, χ, are quantified. Also, the length scale of terms in the energy equation are shown via spectral analysis. Finally, the mixing efficiency, $\Gamma = \chi/\epsilon$, is shown to be similar for all simulations despite the differing initial conditions.

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