Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Prandtl Number Dependence of Stratified Turbulence[1] JESSE LEGASPI, MICHAEL L. WAITE, University of Waterloo — Stratified turbulence is affected by buoyancy forces that suppress vertical motion, resulting in horizontal layers of quasi-two-dimensional vortices. The Prandtl number Pr (or Schmidt number) quantifies the relative strengths of viscosity and buoyancy diffusivity which damp small-scale fluctuations at different microscales. Direct numerical simulations (DNS) must resolve the smallest features, requiring high resolution for large Pr (e.g. $Pr = 7$ in heat-stratified water and 700 in salt-stratified water). To reduce this computational demand $Pr = 1$ is often assumed, possibly introducing discrepancies between DNS and real geophysical flows. In this work, DNS of homogeneous forced stratified turbulence with $Pr = 0.7$, 1, 2, 4, and 8 are performed for varying stratification strength. Energy spectra, buoyancy flux spectra, spectral energy flux, and physical space fields are compared for scale-specific Pr-sensitivity. Intermediate and large scale Pr-dependence was found in addition to expected small-scale sensitivity. Based on our results, the $Pr = 1$ assumption is not realistic for DNS of $Pr > 1$ stratified turbulence: the effects at intermediate, and in some cases, large horizontal scales must be considered, though the computational demand can be prohibitive.

[1]This research was enabled in part by support provided by the Shared Hierarchical Academic Research Computing Network and Compute/Calcul Canada, and funding from the Natural Sciences and Engineering Research Council of Canada (Grant No. RGPIN-386456-2015) and the Canadian Foundation for Innovation.

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Date submitted: 31 Jul 2019 Electronic form version 1.4