Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Wall-bounded stably-stratified turbulence at high Reynolds number FRANCESCO ZONTA, Institute of Fluid Mechanics and Heat Transfer, TU Wien, PEJMAN HADI SICHANI, Polytechnic Department, University of Udine, ALFREDO SOLDATI, Institute of Fluid Mechanics and Heat Transfer, TU Wien
— Wall-bounded stably stratified turbulence is encountered in many industrial and natural processes. Examples include fluid motion in heat transfer devices or transport/mixing of organic species in terrestrial water bodies. In this work, we focus on stably stratified turbulent channel flow at high shear Reynolds number Re_τ. We perform a campaign of pseudo-spectral direct numerical simulations (DNS) of the governing equations, written under the Boussinesq approximation, in the shear Richardson number space $Ri_\tau = Gr/Re_\tau^2$ (which measures the relative importance of buoyancy compared to inertia, with Gr the Grashof number). In particular, we fix the Reynolds number $Re_\tau = 1000$ and we change Gr so to cover a broad range of Ri_τ values. For increasing Ri_τ, turbulence is sustained only near the boundaries, whereas non-turbulent wavy structures (Internal Gravity Waves, IGW), also flavored by the presence of intermittent bursts, are observed at the core of the channel. Naturally, the presence of IGW alters the overall transfer rates of momentum and heat, as well as the mixing efficiency of the flow. We believe that the present results may give important contributions to future turbulence parametrization and modeling in this field.

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Date submitted: 31 Jul 2019 Electronic form version 1.4