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# Understanding the Very Stable PBL using Direct Numerical Simulation

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We use here direct numerical simulation of Ekman flow with an appropriate Dirichlet boundary condition to study turbulence in a prototype stable boundary layer. The stratification in terms of a bulk Richardson number is varied between $\mathbf{Ri} = 0$, that is, a neutral reference and initial state and $\mathbf{Ri} = 0.62$ where the initially turbulent flow relaminarizes temporally. In terms of this free parameter, we can reproduce weakly, intermediately and strongly stable turbulence. In particular, we observe global intermittency despite the absence of external forcing other than an external pressure gradient which drives the Ekman boundary layer.

Such a well-defined setup allows for a systematic study of turbulence regimes in the stable boundary layer. This aids the investigation and understanding of dynamics of globally intermittent and very stable turbulence where large-eddy simulations have difficulties and observations are limited.

The globally intermittent flow is studied in terms of the mean wind, the flow enstrophy, and kinetic energy of the mean and perturbations. We find that in the outer layer the perturbation kinetic energy increases due to irrotational motions as measured by the enstrophy and intermittency. This behaviour is attributed to internal gravity waves. Attempts are made to understand the dynamics of this complex flow by means of statistics conditioned on the turbulent and non-turbulent parts of the flow. We provide strong evidence that intermittency is constrained by the bulk quantities of the flow, and is triggered by available flow instabilities, which in our case are internal gravity waves dominating the dynamics in the outer region of the boundary layer.