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Energy spectra of stably stratified turbulence YOSHIFUMI KIMURA, Nagoya Univ., JACKSON HERRING, NCAR — Energy spectra for forced stably stratified turbulence are investigated numerically using the Direct Numerical Simulations (DNS) with 1024^3 grid points. The calculation is done by solving the 3D Navier-Stokes equations under the Boussinesq approximation pseudo-spectrally. Using toroidal-poloidal decomposition (Craya-Herring decomposition), the velocity field is divided into the vortex mode (ϕ_1) and the wave mode (ϕ_2). The ϕ_1 and ϕ_2 spectra as a function of horizontal wave numbers, $k_\perp$, has the form of

$$E_{\perp\Phi_1}(k_\perp) = \begin{cases} \alpha\eta_{\perp\Phi_1}^{2/3} k_\perp^{-3} & (k_\perp < k_c) \\ C_K \varepsilon_{\perp\Phi_1}^{2/3} k_\perp^{-5/3} & (k_\perp > k_c) \end{cases},$$

$$E_{\perp\Phi_2}(k_\perp) = \begin{cases} \beta\sqrt{N\varepsilon_{\perp\Phi_2}} k_\perp^{-2} & (k_\perp < k_c) \\ C_K \varepsilon_{\perp\phi_2}^{2/3} k_\perp^{-5/3} & (k_\perp > k_c) \end{cases}.$$

where $\eta_{\perp\phi_1}$ and $\varepsilon_{\perp\phi_2}$ are the horizontal enstrophy dissipation based on the ϕ_1 energy and the horizontal energy dissipation based on the ϕ_2 energy, respectively. For both cases, $C_K \approx 1.2 \sim 2.0$ is obtained being close to the Kolmogorov constant. To understand the reason for the steeper spectra than the Kolmogorov -5/3 for large scales, inviscid calculations (truncated Euler's equation) without forcing are conducted. We verified that emergence of steeper spectra for large scales and thermalization spectra for small scales.

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