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Small-scale turbulence in stably stratified flows SABA ALMALKIE, STEVE DE BRUYN KOPS , University of Massachusetts, Amherst — We study statistical characteristics of small-scale turbulence under the stabilizing effect of stratification using direct numerical simulations of horizontally homogeneous, vertically stratified turbulence. The simulations use up to $4096 \times 4096 \times 2048$ grid points to resolve the dissipation scales over a range of Froude and buoyancy Reynolds numbers. The focus is on the effects of large-scale anisotropy associated with different levels of stratification on the dynamics and isotropy of small scales. The isotropy of small scales is addressed in terms of full statistical analysis of the velocity gradient tensor up to the fourth order. Our results reveal the two dominant dynamics of stratified turbulence as three-dimensional turbulence and background stratified flow. These two competing dynamics affect each component of the velocity gradient tensor differently. As a result, statistical characteristics of kinetic energy dissipation rate depend on the stratification level. The probability density function of local energy dissipation rate reflects these two dominant dynamics by exhibiting a bimodal distribution. The results shed light on the definition of proper surrogates for energy dissipation rate in flows dominated by stratified turbulence.

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