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Kinetic and potential energy cascade mechanisms in sheared, stably stratified turbulence LONG ZHANG, Duke University, GAVIN PORTWOOD, Los Alamos National Laboratory, ROHIT DHARIWAL, Washington State University, ANDREW BRAGG, Duke University — In Carbone & Bragg (J. Fluid Mech., 883, 2020 , R2), we used theory and Direct Numerical Simulations (DNS) to explore the mechanisms of the energy cascade in isotropic turbulence. Concerning the average energy cascade, the analysis showed that the dominant mechanism comes from the self-amplification of the filtered strain-rate, with a smaller but significant contribution from the stretching of filtered vorticity. Here we advance the analysis to sheared, stably stratified turbulence. This is a much more complex flow, involving cascades of both kinetic and potential energy, internal waves, strong anisotropy, and the suppression of vertical fluctuations due to buoyancy. We analyze the cascades above and below the Ozmidov scale, exploring the roles of the nonlinear amplification of the filtered strain-rate, vorticity, and density gradients fields, and how these amplification processes vary in different directions of the flow. We find that the relative sizes of the contributions to the kinetic energy cascade from the self-amplification of the strain-rate and vortex stretching depends strongly upon direction, and that the sign of these terms can even change for different directions. We also explore the statistical geometry of the flow, upon which these amplification processes depend.

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