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Large-scale and Small-scale Turbulent Structures in a Stably Stratified Shear Layer[1] TOMOAKI WATANABE, Nagoya University, JAMES J. RILEY, University of Washington, KOJI NAGATA, Nagoya University, KEIGO MATSUDA, RYO ONISHI, JAMSTEC — Title: Large-scale and Small-scale Turbulent Structures in a Stably Stratified Shear Layer Turbulent structures in a stably stratified shear layer are investigated with direct numerical simulations (DNS). Initial mean streamwise velocity and density are given by hyperbolic tangent functions and, therefore, shear and stratification are localized in a thin layer with an initial thickness of h_0. The DNS uses a very large computational domain in horizontal directions. The Reynolds number and Richardson number based on h_0 and the density and velocity differences across the shear layer are 2000 and 0.06, respectively. Turbulence develops from the initial conditions, grows, and then it rapidly decays with time. Flow visualization employing the second invariant of the velocity gradient tensor confirms that a large number of hairpin vortices appear near the edge of the shear layer at late time in the simulation. Very elongated flow structures are also found for the streamwise velocity visualized on a horizontal plane, where the length of these long structures is about 10 times larger than the shear layer thickness. It is also shown that the length scales associated with the hairpin vortices and the elongated flow structures make large contributions to turbulent kinetic energy.

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Tomoaki Watanabe
Nagoya University

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