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Stable stratification in turbulent channel flow FRANCESCO ZONTA, MIGUEL ONORATO, University of Torino, ALFREDO SOLDATI, University of Udine — Stable stratification (bottom-up cooling) is of great importance, since it is encountered in industrial applications, environmental processes and geophysical flows. Turbulent entrainment and mixing across density interfaces in terrestrial water bodies (oceans, lakes and rivers) or at the boundaries between water bodies and the atmosphere, are just some important examples of stably-stratified flows. In this work we use direct numerical simulation to investigate the fundamental physics of stably-stratified turbulent channel flow of water with temperature dependent viscosity and thermal expansion coefficient. Compared to the neutrally-buoyant case, stable stratification induces a general suppression of turbulence levels, momentum and buoyancy fluxes. We observe that the effect of temperature-dependent fluid properties may be important. The most striking feature produced by temperature-dependent fluid properties is local flow laminarization in the cold side of the domain (for temperature-dependent viscosity) or in the hot side of the domain (for temperature-dependent thermal expansion coefficient).

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