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Non- Oberbeck- Boussinesq effects in Poiseuille- Rayleigh-Bénard turbulent channel flow ALFREDO SOLDATI, Center for fluid Mechanics and Hydraulics, University of Udine, FRANCESCO ZONTA, Dept. Physics, University of Torino — The importance of the Oberbeck-Boussinesq (OB) approximation in turbulent Poiseuille-Rayleigh-Bénard (PRB) flow is established via Direct numerical Simulation (DNS) of water flows with viscosity (μ) and thermal expansion coefficient (β) purely varying with temperature (non-Oberbeck-Boussinesq conditions, NOB). In PRB flows, the combination of buoyancy driven/pressure driven effects produce a complex flow structure, which depends on the relative intensity of the flow parameters (i.e. the Grashof number, Gr, and the shear Reynolds number, Re_τ). In liquids, however, temperature variations induce local changes of fluid properties which influence the macroscopic flow field. We present results for different shear Richardson numbers ($Ri_\tau = Gr/Re_\tau^2$) under constant temperature boundary conditions. As the Richardson number is increased, buoyant thermal plumes are generated. Rising and falling thermal plumes induce large scale thermal convection which increases momentum and heat transport efficiency. Analysis of friction factor (C_f) and Nusselt number (Nu) for NOB conditions shows that the effect of $\mu(T)$ is negligible, whereas the effect of $\beta(T)$ is critical.

Alfredo Soldati
Center for fluid Mechanics and Hydraulics, University of Udine

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