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Effects of Natural Convection on the Near-Wall Turbulence in Unstably Stratified Turbulent Channel Flows[1] SAMIR SID, VINCENT TERRAPON, Dept. of Aerospace and Mechanical Engineering, University of Liege, Liege, Belgium, YVES DUBIEF, School of Engineering, University of Vermont, Burlington VT — Results of direct numerical simulation of turbulent channel flows under unstable stratification are reported. Two Reynolds number are considered: $\mathrm{Re}_\tau = 180, 395$ and the Rayleigh number ranges between $\mathrm{Ra} = [10^6 - 10^9]$. The Prandtl number is set to 1. The channel is periodic in both streamwise and spanwise directions and non-slip/isothermal boundary conditions are imposed at the walls. The temperature difference between the walls is set so that the stratification is unstable and the coupling between temperature and momentum is achieved using the Boussinesq approximation. The dependency of the typical large scale convective structures on both Reynolds and Rayleigh numbers are investigated through cross flow sectional statistics and instantaneous flow field visualizations. Moreover, the effects of the natural convection on the coherent structures associated to the cycle of wall-bounded turbulence (Jimenez, *et al.* JFM 1999), namely velocity streaks and streamwise vortices, are examined. Finally, macroscopic quantities such as friction coefficient and Nusselt number are reported as a function of the Rayleigh number and are compared for both Reynolds numbers.

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