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Direct numerical simulations of mixed convection in a turbulent channel flow[1] SAMIR SID, VINCENT TERRAPON, University of Liege, YVES DUBIEF, University of Vermont — Wall-bounded turbulence has been extensively studied by the scientific community during the last decades. Much effort has been devoted to identify the role that coherent structures and energy exchanges play in turbulent channel flows. However, in many engineering applications, wall-bounded flows are subjected to additional physical phenomena. For instance, applying a temperature differential to the channel walls leads to a modified turbulent state which results from a balance between buoyancy, inertia and viscosity effects. Although, forced and natural convection have been widely studied separately, the coupling between both and its consequences on turbulence features are still not fully understood. In the present work, direct numerical simulations of a buoyant turbulent channel flow are reported for different values of the Reynolds and Richardson numbers. The energy exchanges between potential and kinetic energy and their impact on coherent structures are investigated. Macroscopic quantities (e.g.: Nusselt number) and statistics are compared with those obtained in forced convection flows. Finally, the influence of the ratio between inertia and buoyancy effects (i.e. Richardson number) is discussed.

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