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Turbulent natural convection in a cavity with a free surface under non-Oberbeck-Boussinesq conditions WILLIAM HAY, MILTIADIS PAPALEXANDRIS, Universite catholique de Louvain — Turbulent natural convection of liquids is encountered in many environmental and industrial applications. For example, in the oceans, the buoyant flow of water due to temperature and concentration gradients has been studied extensively over the years. More recently, highly turbulent flows of a similar nature are being studied to better understand thermal mixing in nuclear spent fuel pools under accidental conditions. In such a case, the Rayleigh number can be as high as 10^{14}. Moreover, due to significant temperature variations, the water transport properties can no longer be considered as constant. Therefore, the validity of the Oberbeck-Boussinesq approximation for the flows of interest becomes questionable. In this talk we present results from both direct numerical and large-eddy simulations of a cuboid domain, periodic in the longitudinal direction, with a free-slip upper boundary and with water as the working fluid under non-Oberbeck-Boussinesq conditions. Over a series of simulations at increasing Rayleigh number we assess the impact of the free-slip boundary and variable fluid properties on the turbulent flow statistics.

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