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Constant power input simulations of drag reduced viscosity stratified turbulent channel flow OSCAR NAZARENKO, TU Wien, ALESSIO ROCCON, TU Wien; University of Udine, FRANCESCO ZONTA, TU Wien, ALFREDO SOLDATI, TU Wien; University of Udine — In this work, we analyze the energy budgets of a turbulent channel flow in which a thin layer of fluid is used to lubricate the flow. In particular, we consider a setup in which a thin layer of fluid (viscosity η_1) is used to lubricate the flow of a thicker fluid layer (viscosity η_2). The system dynamics is investigated numerically performing DNS of the Navier-Stokes equations coupled with a phase-field method. We consider a single-phase case and three multiphase cases. The multiphase cases differ by the value of the viscosity ratio employed: $\lambda = 1.00$ (matched viscosity), $\lambda = 0.50$ and $\lambda = 0.25$ (less viscous lubricating layer). In order to obtain a more meaningful comparison among the different cases, simulations are performed using a Constant Power Input (CPI) framework and the power Reynolds number is kept fixed to $Re_\Pi = 12220$ (corresponding in the single-phase reference case to $Re_\tau \simeq 300$). The results show that for all the cases considered, with respect to single-phase reference case, an increase of the thicker layer flow-rate is observed and Drag Reduction (DR) is obtained. The DR is linked to the interplay between inertial, viscous and surface tension forces which lead to an overall reduction of the turbulent dissipation.

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