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Subgrid scale physics in a turbulent boundary layer flow under varying convective stability conditions: an a-priori study ELIE BOU-ZEID, Princeton University, NIKKI VERCAUTEREN, CHAD HIGGINS, HENDRIK HUWALD, MARC B. PARLANGE, Ecole Polytechnique Federale de Lausanne-EPFL, CHARLES MENEVEAU, Johns Hopkins University — Using data sets collected during the Lake Atmosphere Turbulent Exchanges (LATEX, convectively unstable conditions) and the Snow Horizontal Array Turbulence Study (SnoHATS, convectively stable conditions) field experimental campaigns, we study the impact of this convective stability on the physics of small scale turbulence in the atmospheric boundary layer flow and the implications for modeling the subgrid scales stresses and fluxes (of heat and moisture) in large eddy simulation. Results indicate that the subgrid scale turbulent Prandtl number increases significantly as the flow transitions from unstable to stable. Under all stabilities, the TKE and scalar variance dissipation estimated based on the structure functions are very good estimates of the flux of energy to the subgrid scales; however, under stable conditions, a significant fraction of the TKE flux is destroyed by buoyancy rather than by viscous dissipation. Finally, the effect of stability on the coefficients of 2 SGS models is shown to be better explained by the Ozmidov scale under stable conditions. Overall, these results indicate that subgrid scale modeling is not drastically affected by atmospheric stability and hence a unified approach is possible.

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