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Direct numerical simulation of stably-stratified turbulent channel flows with strongly property changes YOSHINOBU YAMAMOTO, Nagoya University, TOMOAKI KUNUGI, Kyoto University, SHIN-ICHI SATAKE, Tokyo University of Science — In this study, Direct Numerical Simulations of stably- stratified turbulent channel flows were conducted to investigate strongly property change and buoyancy effects on turbulent structures and heat transfer. Fully-developed stably-stratified turbulent channel flows at CO_2 supercritical pressure (7.58MPa) were treated as the flow fields. Constant temperature conditions were considered as the thermal boundary conditions: top and bottom wall temperatures kept at 32.7 and 31.7 degrees, respectively. In this temperature range, thermal properties of CO_2 were strongly changed and have a sharp peek at 32.2 degree. At first, numerical investigation was carried out in case of passive scalar transport to evaluate the grid resolutions for thermal property change. Next, DNS database under forced convection conditions: Turbulent Richardson number (Ri) between 0 and 15, were constructed. As the results, in passive scalar case (Ri=0), effects of high- Pr fluid characteristic and property change on the budget of mean energy equation were remarkably appeared. The spanwise turbulent heat flux due to the property change and the high and low-speed streaky structures was dominant to energy equation budget near wall. In stable cases, the tendency of flow laminarization was observed due to the buoyancy, but its effects on turbulent statistics seem to be inactive compared with low-Pr fluid case in the same Ri condition.

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