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**A zero-equation closure model for wall-bounded stably stratified flows**[1] FARID KARIMPOUR[2], SUBHAS KARAN VENAYAGAMOORTHY[3], Colorado State University — In this study, we propose a parameterization for the turbulent Prandtl number ($Pr_t$) for stably stratified wall-bounded flows. To date, most of the widely used parameterizations for $Pr_t$ for stably stratified flows are based on data from homogeneous flows and are usually formulated as functions of the gradient Richardson number ($Ri_g$). The effect of the wall boundary is completely neglected. We introduce a modified parameterization for $Pr_t$ that takes into account the inhomogeneity caused by the wall coupled with the effects of density stratification. We show that in wall-bounded flows, the turbulent Prandtl number has a different behavior from homogeneous flows. We evaluate the new parameterization by using a zero-equation turbulence model for the eddy viscosity that was proposed by Munk and Anderson in 1948 to simulate a one-dimensional stably stratified channel flow. Comparison of the one-dimensional simulation results with direct numerical simulation of stably stratified channel flow results show remarkable agreement. We also compare other commonly used parameterizations of $Pr_t$ for homogeneous flows to highlight their shortcomings in predicting both momentum and scalar mixing correctly in wall-bounded flows.

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