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Evaluation of turbulent Prandtl (Schmidt) number parameterizations for stably stratified turbulent flows[1] ZACHARY ELLIOTT[2], SUBHAS VENAYAGAMOORTHY, Colorado State University — In this study, we evaluate four different formulations of the turbulent Prandtl (Schmidt) number $Pr_t = \nu_t/\Gamma_t$ where ν_t is the eddy viscosity and Γ_t is the scalar eddy diffusivity, for stably stratified flows. All four formulations of Pr_t are strictly functions of the gradient Richardson number Ri which is a measure of the strength of the stratification. A zero equation turbulence model for the eddy viscosity ν_t in a one-dimensional, turbulent channel flow is considered to evaluate the behavior of the different formulations of Pr_t. Both uni-directional and oscillatory flows are considered to simulate conditions representative of practical flow problems such as atmospheric flows and tidally-driven estuarine flows, to quantify the behavior of each of the four formulations of Pr_t. We discuss which of the models of Pr_t allow for a higher rate of turbulent mixing and which models significantly inhibit turbulent mixing in the presence of density stratification. The basis underlying the formulation of each model in conjunction with the simulation results are used to highlight the importance of choosing the appropriate parameterization of Pr_t, given a model for ν_t in for stably stratified flows.

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