Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Evaluation and Improvement of RANS models for Stably Stratified Turbulence FARID KARIMPOUR, SUBHAS VENAYAGAMOORTHY, Colorado State University — The focus of this study is to account for the effects of buoyancy forces in RANS models for stratified turbulence. To this end, changes to the stratification parameters that account for buoyancy effects in RANS models are proposed. DNS data of stably stratified turbulence are used to study the parameters in two equation turbulence models such as the buoyancy parameter $C_{\epsilon 3}$, and the turbulent Prandtl number Pr_t in the k-ϵ model. Both the gradient Richardson number $Ri = N^2/S^2$, where N is the buoyancy frequency and $S = d\overline{u}/dz$ is the mean shear rate, and the turbulent Froude number $Fr_k = \epsilon/(Nk)$, are used as correlating parameters to characterize stratification in the k-ϵ model. We show that it may be more appropriate to use Fr_k as the parameter of choice for modeling the stratification parameters in the k-ϵ model since it is based on the local properties of the turbulence as opposed to Ri, which is a mean property of the flow. The proposed modifications were implemented in a 1-D water column model called the General Ocean Turbulence Model (GOTM) and used to simulate stably stratified channel flows. The results from numerical simulations using the modified k-ϵ model are compared to DNS data of stably stratified channel flow to assess its efficacy. This modified formulation is also compared with other stability functions in GOTM.

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Date submitted: 08 Aug 2011 Electronic form version 1.4