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Near-wall SGS modeling for LES of an Isothermal Wall using ODT[1] PAUL DESJARDIN, HARMANJEET SHIHN, University at Buffalo, the State University of New York — A novel coupling approach is developed for One-Dimensional Turbulence (ODT) as near-wall subgrid scale model for Large-Eddy Simulation (LES). In this approach, all near-wall molecular processes are completely resolved using a 1D embedded grid that lies normal to the wall surface which partially overlaps with the filtered field. The SGS stresses are constructed using the vector and variable density ODT model and are used to evolve the LES equations. Within the ODT domain the effects of unresolved 3D turbulent mixing processes associated with the wall surface tangential directions is modeled using a sequence of triplet mapping stirring events. A modification to eddy selection is proposed in this description to take into account the physical process of air engulfment from long wavelength instability modes by adding a buoyancy generation production term. The near-wall vortex structures generated in the coupled LES-ODT simulation of a turbulent boundary layer along an isothermal wall indicates that the near-wall small scales have a profound affect on the large scale structures. The results show a significant improvement in the prediction of near-wall quantities using the LES-ODT approach over standard LES approaches at only a fraction of the cost associated with DNS.

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