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Numerical modelling of the nonhydrostatic mesoscale stratified flows

In this research, the evolution of dry thermals in a stratified atmosphere has been investigated to study the development of a nonhydrostatic atmospheric model. In designing such models, one needs to minimize artificial energy dissipation at the resolved scale, and parameterize the effect of unresolved turbulent mixing. First, we have adopted the standard mesoscale filtering of conservation laws (mass, momentum, and energy) assuming that the characteristic scale of circulation is much less than the density scale hight of the atmosphere. Second, we have filtered the mesoscale equations with a Deslauriers–Dubuc (DD) wavelet system along with a Smagorinsky type eddy viscosity model. The DD wavelet results in a non-dissipative advection scheme. The time integration is performed by projecting the solution onto a Krylov subspace, and by solving the system with the GMRES (generalized minimal residual) algorithm. In this talk, I will present numerical simulation of internal wave generated penetrative convection in a stratified environment.

This is a joint work with Dr. Jahrul Alam (Memorial University of Newfoundland)