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MMM SEMINAR *NCAR*

Mesoscale Modeling at High (but not Turbulence-Resolving) Resolution

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This talk discusses an issue associated with meteorological modeling with fine [O(1km)] grid meshes. The scales resolved by these meshes are small enough to capture features of the larger turbulent eddies that may exist in the planetary boundary layer (PBL), but too large for the simulation of the turbulent cascade that regulates their amplitude and structure, as would occur in a Large-Eddy Simulation (LES) where grid meshes are O(10m). Until recently larger [O(10km)] grid meshes were typically used for mesoscale modeling, but now increases in computational capability are making possible higher-resolution mesoscale modeling. The issue addressed in this talk is that PBL parameterizations developed for the larger-grid-mesh simulations may in fact set up situations in which the mesoscale model produces convectively unstable motions, the reason being that in an attempt to represent observed heated-PBL profiles, most parameterizations produce potential-temperature profiles that are superadiabatic over much of their depth. From the point of view of a mesoscale model, however, these profiles are absolutely unstable and are prone to producing circulations at the minimum resolved scale (typically 4-6 times the horizontal mesh size) at short lead times since the growth rate is inversely proportional to the resolved scale. Although the production of these circulations corresponds to a real physical process, the smaller-scale turbulence that determines the ultimate form taken by these motions (i.e. whether they be regular or randomly distributed in space) depends on scales not resolved by the mesoscale model. For mesoscale models with grid meshes O(1km), the motions immediately downscale of the minimum resolved scale are too large to fall within the inertial subrange of turbulence and no theory based on first principles exists for the parameterization of their effects. In the present study we turn to simulations with resolution high enough to simulate turbulent transfer (i.e. LES) as a guide to the physical regimes where structural features such as quasi-steady, quasi two-dimensional circulations may occur in the heated PBL.

This seminar will be recorded and available via webcast at:
http://www.fin.ucar.edu/it/mms/fl-live.htm

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Refreshments 3:15 PM
NCAR-Foothills Laboratory
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