ACINN Graduate Seminar, Innsbruck University
Location: Seminar Room on the 8th Floor of Bruno-Sander-Haus (60819SR)
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Three-Dimensional Planetary Boundary Layer Parameterization for High-Resolution Mesoscale Simulations

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In numerical weather prediction (NWP) models, turbulent stresses and fluxes are commonly parameterized using one-dimensional parameterizations based on the assumption of horizontal homogeneity. If horizontal grid cell sizes are relatively large (e.g., greater than 10 km) this assumption is justified. As the grid-cell size of mesoscale simulations decreases, however, the assumption of horizontal homogeneity is violated and the effect of horizontal gradients should be accounted for. These three-dimensional effects at mesoscale grid-cell size are particularly pronounced in flows over complex terrain.

We have developed and implemented a 3D planetary boundary layer (PBL) parameterization in the Weather Research and Forecasting (WRF) model to account for 3D effects on TKE and turbulent stresses and fluxes. The 3D PBL parameterization is an algebraic stress and flux parameterization based on the developments of Mellor and Yamada (1982). At present the parameterization implemented in WRF is Level 2 according to Mellor and Yamada (1982) classification, where the TKE is diagnosed.

We will present evaluations of the 3D PBL performance of idealized numerical experiments as well as with data from field experiments in complex terrain, relying on the WFIP2 experiment in the Pacific Northwest of North America. Preliminary results show that the horizontal normal turbulent stress components as well as one of the shear stress components, $\langle u'v' \rangle$, are underpredicted, while the two turbulent shear stress components, $\langle u'w' \rangle$ and $\langle v'w' \rangle$ are accurately predicted. Overall, the 3D PBL parameterization results in slightly better correlation with observations, essentially the same RMSE, and significantly improved variance.

Mellor, G. L., and T. Yamada, 1982: Development of a turbulence closure model for geophysical fluid problems. *Rev. Geophys.*, **20**, 851–875, doi:10.1029/RG020i004p00851.