Geophysical Research Abstracts
Vol. 20, EGU2018-16280, 2018
EGU General Assembly 2018

Implementation of the hybrid cumulus parametrization scheme HYMACS into ICON

Michael Langguth and Andreas Bott
Rheinische-Friedrich-Wilhelms University of Bonn, Meteorological Institute, Bonn, Germany (mlangguth@uni-bonn.de)

Cumulus convection plays an important role in driving atmospheric circulations and in causing heavy precipitation events. Hence, the proper representation of deep convection is crucial for the performance of numerical weather prediction (NWP) models.
While classical parametrization schemes for deep convection incorporate a net vertical subgrid scale transport of moisture, enthalpy and momentum including simplified cloud physics, the net mass flux is assumed to vanish. The assumption of compensating mass transports by subgrid scale updrafts, downdrafts and environmental subsidence within a single grid column becomes more and more questionable when the grid spacing approaches the convective grey zone ($\Delta x \sim$ 1-10 km).

To overcome this conceptual problem, the hybrid mass flux convection scheme HYMACS, which transfers the environmental subsidence to the grid scale, has been designed. HYMACS has already been tested successfully in the regional NWP model COSMO (COnsortium for Small-scale MOdeling) developed and maintained by the German Meteorological Service (DWD).
Our project aims to implement the convection parametrization scheme HYMACS into the new global NWP model ICON (ICOsahedral Nonhydrostatic) jointly developed by the DWD and the MPI-M. The implementation of HYMACS into ICON is expected to improve the model's thermodynamical response to convection.

In the first step, idealized dry mass lift experiments without any enthalpy transport are performed. For this purpose, within a single grid column a mass sink in the lowermost grid box and a mass soruce aloft are introduced representing an entraining and detraining plume. The induced dynamics are analyzed with special regard to the generation of gravity waves, grid scale convergence as well as divergence patterns and the grid scale subsidence.
For further investigations of the synthesis of the convection parametrization scheme HYMACS with the ICON model, we also set up moist convection experiments. Cloud condensation within an idealized plume leads to an acceleration of the updraft air and enables overshooting of moist air. The dynamical response is again analyzed in detail, but focusses more on the buoyancy induced circulation pattern due to the entrainment of relative cold air above the equilibrium level.