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The ICON model hierarchy: towards cloud resolving scales

Daniel Klocke (2), Matthias Brueck (1), and Cathy Hohenegger (1)
(1) Max Planck Institute for Meteorology, The Atmosphere in the Earth System, Hamburg, Germany
(matthias.brueck@mpimet.mpg.de), (2) Deutscher Wetterdienst, Offenbach, Germany

Convection permitting simulations for the tropical Atlantic region (9000x3300 km) are performed using the icosahedral non-hydrostatic (ICON) general circulation model, jointly developed by MPI-M and DWD. The motivation is: a.) better physical process understanding of cloud, convection and circulation (via connecting the small and large scales), b.) support of observational campaigns (mission and flight planning via providing a virtual test-best), in turn c.) use the corresponding observational data for modal evaluation and d.) thereby integrating research communities from measurements and modeling.
Short forecast simulations of 36 hours are performed for over 60 days accompanying the NARVAL observations campaign in Dec 2013 and Aug 2016 using a grid spacing of 2.5 km and a 1.2 km in a nested domain. This data further serves to drive a second set of simulations in context to the HD(CP)2 project using 600, 300 and 150 m grid spacing. The model setups are related NWP setup of ICON, but the kilometer scale simulations explicitly treat convection and the sub-kilometer simulations are further using the 3D Smagorinsky turbulence parameterization (ICON-Large Eddy Model).
As deep convection is a key process in tropical and subtropical regions, the explicit evolution of convection across a wide range of horizontal scales produces rich interactions with their environment and neighboring convective cells, producing emergent phenomena like cold pools, gravity waves, convective self-aggregation and even hurricanes.