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UA-ICON - A non-hydrostatic global model for studying gravity waves from the troposphere to the thermosphere

G. Zhou (1), S. Borchert (2), H. Schmidt (1), E. Manzini (1), G. Zängl (2), and M. Baldauf (2)
(1) Max-Planck-Institut für Meteorologie, Hamburg, Germany, (2) Deutscher Wetterdienst, Offenbach, Germany

In climate simulations as well as numerical weather prediction, there are ongoing efforts to raise the upper model lid, acknowledging the possible influence of middle and upper atmosphere dynamics on tropospheric weather and climate. As the momentum deposition of gravity waves (GWs) is responsible for key features of the large scale flow in the middle and upper atmosphere, the upward model extension has put GWs in the focus of atmospheric research needs. The Max Planck Institute for Meteorology (MPI-M) and the German Weather Service (DWD) have been developing jointly the non-hydrostatic global model ICON (Zängl et al, 2015) which features a new dynamical core based on an icosahedral grid. The extension of ICON beyond the mesosphere, where most GWs deposit their momentum, requires, e.g., relaxing the shallow-atmosphere and other traditional approximations as well as implementing additional physical processes that are important to the upper atmosphere, i.e. GW-induced turbulence, molecular diffusion, ion drag, ultraviolet and extreme ultraviolet solar radiation, long wave radiation under non-local-thermodynamical-equilibrium etc. Here we present aspects of the model development and its evaluation, in terms of the general circulation and GW forcing. This work is part of the research unit Multi-Scale Dynamics of Gravity Waves (MS-GWaves), sub-project Gravity Wave Interactions in the Global Atmosphere (GWING), funded by the German Research Foundation.