EGU2020-15837, updated on 28 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-15837
EGU General Assembly 2020

Numerical modeling towards the sub-kilometer scale: The potential for regional reanalysis

Arianna Valmassoi[1,2], Jan Keller[2,3], Petra Friederichs[1], and Andreas Hense[1]
[1]Institute of Geosciences, Meteorology Section, University of Bonn, Germany
[2]Hans-Ertel-Centre for Weather Research, Climate Monitoring and Diagnostics, Germany
[3]Deutscher Wetterdienst, Offenbach, Germany

In recent years convection-permitting models are increasingly often used for retrospective climate studies. Besides the better reproduction of atmospheric processes, the increase in resolution allows for a more accurate representation of land-surface heterogeneities and thus a more realistic depiction of smaller scale characteristics. The work presented here investigates the potential benefits of higher model resolutions on the atmospheric state estimates in possible future regional reanalysis data sets.

Specifically, we employ the ICOsahedral Non-hydrostatic model ICON (the current operational NWP model of the German Meteorological Service DWD) in its Limited Area Mode (ICON-LAM) with a LETKF data assimilation framework.
Simulations are conducted for a free run (dynamical downscaling) and a data assimilation (DA) one for various horizontal resolutions from the operational 2.1 kilometers towards finer resolutions of 1 kilometer and below. In addition, different land surface data sets are used as lower boundary conditions in order to explore their impact under the chosen horizontal resolutions. These experiments are conducted for Central Europe and Germany for the month of June 2019 which includes several extreme events, e.g., heatwave, heavy precipitation.

The presentation evaluates the simulations against non-assimilated observations for the free and DA experiments. The impact of the land-surface heterogeneity and resolution are quantified on both atmospheric and soil variables to account for possible feedback processes. Particular attention is given to the effects on the vertical atmospheric structure and precipitation generation.