



Influence of spectral nudging on convection permitting simulations

Nauman Khurshid Awan and Ivonne Anders

Zentralanstalt für Meteorologie und Geodynamik, Vienna, Austria (nauman.awan@zamg.ac.at)

Recent projects focusing on high resolution regional climate simulations (3 km and below) have opened a new field of research within the regional climate modelling (RCM) community. The so-called convection permitting scales have been of particular interest for many research groups as convection remains an important phenomenon still not correctly represented in models even at such high resolutions. Within the framework of CORDEX-FPS findings in Coppola et. al. 2008 suggest that in climate simulations the large scale fields departs significantly from the driving re-analysis even after a month. However, their experiments have not investigated the role of Spectral Nudging (SN) which is a well-known technique used to restrict the large scale atmospheric state of high resolution RCM from wandering away from the coarser model that is used to provide initial and lateral boundary conditions. This is mainly achieved by restricting all spectra of wave lengths above a certain threshold (depending on model domain size) to conform to the coarser model. Although the main goal of the technique is to improve the representation of large scale features in RCMs without interfering with small scales, it is not that simple to achieve. Theoretically, improvements rendered via spectral nudging in large scale should also improve small or sub synoptic scale features as well. However, changes in the upper parts of atmosphere (typically from model top to 850 hPa) can also lead to physical inconsistencies between upper and lower atmosphere causing adverse results.

In the presented study we investigate the influence of using spectral nudging at convection permitting scales and it's consequent effects on the development of extreme convective events. We investigate six different convective events in the past (between 2000-2018), which developed under different large scale conditions. For each of our six events one month is simulated and ERA-interim is downscaled from 0.70° (~ 78 km) to a spatial resolution of 0.11° (~ 12 km) covering Europe and then to 0.275° (~ 3 km) focusing on central European region with Alps at it's center. To answer the aforementioned research question, we compare the results from the simulations (with/without Spectral Nudging) at both nesting levels and also compare 2m-temperature and precipitation sums for the complete events with gridded observational data sets.