Geophysical Research Abstracts
Vol. 19, EGU2017-12439, 2017
EGU General Assembly 2017

High-resolution WRF-LES simulations for real episodes: A case study for prealpine terrain

Cornelius Hald (1), Matthias Mauder (1), Patrick Laux (1), Harald Kunstmann (1,2)

(1) Karlsruhe Institute for Technology, Institute of Meteorology and Climate Research, Department of Atmospheric Environmental Research (IMK-IFU), Garmisch-Partenkirchen, Germany (cornelius.hald@kit.edu), (2) Institute of Geography, Regional Climate and Hydrology, University of Augsburg, Germany

While in most large or regional scale weather and climate models turbulence is parametrized, LES (Large Eddy Simulation) allows for the explicit modeling of turbulent structures in the atmosphere. With the exponential growth in available computing power the technique has become more and more applicable, yet it has mostly been used to model idealized scenarios.
It is investigated how well WRF-LES can represent small scale weather patterns. The results are evaluated against different hydrometeorological measurements.
We use WRF-LES to model the diurnal cycle for a 48 hour episode in summer over moderately complex terrain in southern Germany. The model setup uses a high resolution digital elevation model, land use and vegetation map. The atmospheric boundary conditions are set by reanalysis data. Schemes for radiation and microphysics and a land-surface model are employed.
The biggest challenge in modeling arises from the high horizontal resolution of $dx = 30m$, since the subgrid-scale model then requires a vertical resolution $dz \approx 10m$ for optimal results. We observe model instabilities and present solutions like smoothing of the surface input data, careful positioning of the model domain and shortening of the model time step down to a twentieth of a second.
Model results are compared to an array of various instruments including eddy covariance stations, LIDAR, RASS, SODAR, weather stations and unmanned aerial vehicles. All instruments are part of the TERENO pre-Alpine area and were employed in the orchestrated measurement campaign ScaleX in July 2015.
Examination of the results show reasonable agreement between model and measurements in temperature- and moisture profiles. Modeled wind profiles are highly dependent on the vertical resolution and are in accordance with measurements only at higher wind speeds. A direct comparison of turbulence is made difficult by the purely statistical character of turbulent motions in the model.