Kurzfassungen der Meteorologentagung DACH
Garmisch-Partenkirchen, Deutschland, 18.–22. März 2019
DACH2019-56

Impact of land-surface heterogeneity on boundary layer – free troposphere coupling and precipitation using the ICON-LEM model

Shweta Singh, Leonhard Gantner, and Norbert Kalthoff
Karlsruhe Institute of Technology, Institute of Meteorology and Climate - Troposphere Research (IMK-TRO), Germany (shweta.singh@kit.edu)

Convective events are the result of different states of the atmospheric modifications due to synoptic scale condition and/or land surface characteristics. A major role in the process chain from land-surface variations, Atmospheric Boundary Layer (ABL) heterogeneity and convection is played by ABL-troposphere coupling – a process that occurs on different scales. The identification, as well as the quantification of this coupling, is important for a better estimation of the occurrence and strength of convection and its influence on heavy precipitation events. Land surface heterogeneity can be defined in terms of differences in soil type, orography, vegetation, and land use etc. These variations along with cloud cover influence the surface turbulent fluxes pattern. Lightning can be taken as a proxy for moist deep convection.
In this study, based on orographic complexities and associated hotspots of convection, we aim at three investigation areas: flat terrain, isolated orography, and complex orography. Suitable days for simulation were selected using the criteria of low wind speed and considerable flash density over the respective areas. The dependence of the diurnal cycle of surface sensible heat flux pattern on the parameters of leaf area index, orography, soil moisture, and net shortwave radiation was measured using the standardized multiple regression coefficients. The source areas of convective cells were identified using the backward trajectory model (LAGRANTO). The atmospheric moisture and heat budget terms have been calculated in order to quantify the coupling. For example, in flat terrain, the source area for convection shows a good correlation with enhanced sensible heat flux pattern and accompanied regions, where the boundary layer is warmer than the surroundings which further induce the formation of secondary circulation system along the lakes of the aimed area. The simulations show a higher boundary layer and faster growth rate over inhomogeneous area in comparison to the homogeneous area. The major energy input comes from the turbulent heat and moisture flux.