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Investigate the impact of land surface heterogeneity on surface fluxes and convection using the ICON-LEM model

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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 study areas: flat terrain, isolated orography and complex orography. Suitable days for simulation were selected using the criteria of low wind speed and considerable number of flashes 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 were measured using the standardized multiple regression coefficients. The source areas of convective cells were identified using the backward trajectory model (LAGRANTO). 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.