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Very high-resolution modeling with COSMO focusing on land-surface impacts

Leonhard Gantner, Norbert Kalthoff, and Vera Maurer
Institut für Meteorologie und Klimaforschung (IMK-TRO, KIT), Karlsruhe, Germany (vera.maurer@kit.edu)

In atmospheric modeling, land surface models constitute the lower boundary condition that mainly determines the partitioning of available energy into the turbulent fluxes of sensible and latent heat. By this, they influence the evolution of the boundary layer (BL), for example its height and the formation of BL clouds. For a realistic modeling of the surface fluxes, especially the land surface parameters such as land use and soil type have to be well represented. Our aim is to compose a dataset of land surface parameters in different horizontal resolutions for use in COSMO and its soil model TERRA-ML that is as realistic as possible and to investigate the effect on the atmosphere. For this, days from the HD(CP)^2 observational prototype experiment (HOPE) were selected when measurements from surface energy balance stations, cloud radars, ceilometers and up to seven lidars (amongst others) are available. These days are simulated with the COSMO model in a very high resolution (≤ 500 m) and land-surface as well as BL characteristics are compared to the measurements. On a cloud-free day for example, spatial variability of the observed sensible heat flux reaches values of up to 200 Wm^{-2} at noon. With the standard configuration of surface parameters, this is not at all reproduced by the model. However, the simulation results improve when using the data in higher horizontal resolution and with more accurate information.