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Influence of topography and wind speed on the diurnal cycle of moist convection in an Idealized framework

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The influence of topography on the diurnal cycle of mid-latitude, summertime, moist convection is investigated in an idealized framework using cloud-resolving model with a horizontal grid spacing of 2 km. In this framework, the atmosphere is continuously relaxed towards prescribed reference profiles of temperature, specific humidity and wind speed. This relaxation mimics the influence of a steady large-scale flow. The strength of the relaxation varies with height. It is relatively strong in the stratosphere and upper troposphere (relaxation time is 2 days), but very weak in the lower troposphere. Apart from its influence on the mean environment, the relaxation has only a minimal influence on the diurnal evolution of the planetary boundary layer and moist convection. The simulations are run for 30 days. During the last 15 days a quasi-steady diurnal cycle is obtained, the diurnal equilibrium. Here, we investigate the influence of different topographies (mountain height and half-width) and wind profiles on the diurnal equilibrium evolution of clouds, precipitation and the associated net vertical fluxes of energy and water. As expected, in comparison to the simulation of flat terrain clouds and precipitation occur earlier over topography and total precipitation amounts are substantially increased. A particular focus will be on the analysis of the mountain effects as a function of the distance from the mountain (e.g. near-field and far-field effects).