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The influence of land-surface heterogeneities on cloud size development

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Land-atmosphere interactions play a crucial role in earth system modelling through their mutal control on the energy budget and its partion. Land surfaces are generally heterogeneous and can alter the development of clouds and precipitation. This can be a source of uncertainties for current climate and Numerical Weather Prediction (NWP) models, where some processes are parameterized. Results of our simulations will help to identify the need to include sub-grid heterogeneities in NWP models. Future scale independent cloud parameterization may contain information about the size distribution of clouds. We are interested how these size distributions change when clouds develop over heterogeneous land surfaces.

In this study we simulate the diurnal cycle of mid-latitude summertime convection with a focus on the transition from shallow to deep clouds. High resolution large-eddy simulation with an interactive land-surface model is used to address the problem. Experiments with different scales of surface heterogeneity are performed and evaluated against a homogeneous control experiment. We identify mechanisms that determine the development of the cloud size statistics over heterogeneous land. The transition from shallow to deep clouds is considerably influenced by heterogeneous land surfaces.