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Parameterizations of land-atmosphere interactions over remotely-sensed, heterogeneous surfaces and comparison of flux and temperature boundary condition formulations

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Large-eddy simulations (LESs) of the atmospheric boundary layer (ABL) over heterogeneous surfaces are performed using a Lagrangian dynamic scale-dependent subgrid-scale model. The heterogeneous terrain is incorporated in the simulations using remotely-sensed datasets of surface roughness and skin temperature from the USDA-ARS El Reno Southern Great Plains (SGP) experiment. In order to differentiate between flow variations induced by the underlying heterogeneity and the variability inherent in the boundary-layer turbulence, simulations are also performed over homogeneous and synthetic heterogeneous surfaces (multiple alternating patches) with the same mean temperature as the remote-sensed surface. The importance of the choice of boundary condition formulation in the form of imposed surface temperature or surface heat fluxes is also assessed. This is accomplished by making comparisons of simulations performed over different setups of surface heterogeneity in the form of surface temperature and surface heat flux with all the different surfaces having the same spatial mean value. The preliminary results suggest that the local flux computation based on surface temperature preserves the impact of variability induced by surface heterogeneity in the spatially averaged flux variables.