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Sensitivity of the SURFEX land surface model to forcing settings in urban climate modelling

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Urbanised areas modify the local climate due to the physical properties of surface objects. The urban effects on local climate interact with regional climate change, resulting in more serious climate change impacts (e.g., more heatwave events) over cities. Majority of urban inhabitants are affected by these enhanced changes. Therefore, investigating the local climate change in cities is of high importance in order to build targeted adaptation and mitigation strategies.

SURFEX externalised land surface model including the TEB urban canopy scheme is a competent tool to serve quantitative information as a base for future decision and planning. We apply the model on 1 km resolution for urban climate research activities. Information about atmospheric conditions is obtained from the ALADIN-Climate regional climate model used at the Hungarian Meteorological Service.

Before longer climate runs, we are conducting some sensitivity analysis to adjust the optimal settings of SURFEX coupled with ALADIN-Climate outputs. In this study we perform several 1-year simulations with SURFEX focusing on the coupling strategy and its effect on the evolution of urban heat island (UHI). Different vertical heights and temporal frequencies of the forcings are tested: i.e. we modify the level of atmospheric fields providing input for SURFEX and also increase the coupling update (to every hour). The domain of the sensitivity study is the city of Szeged in Hungary which is attractive for urban climate investigations due to its flat topography. We consider as a reference dataset a SURFEX/TEB simulation driven by ALADIN-Climate with ERA-Interim lateral boundary conditions, where 3-hour coupling frequency was applied together with 30-meter forcing height. Spatial pattern and temporal evolution of UHI are investigated, moreover gridpoint data is validated against time series of two stations describing rural and urban conditions in the city.

Our aim with these experiments is to estimate the magnitude of the potential improvement in describing urban climate features and possibly to take it into account in the course of designing the future runs (considering also the higher computational and storage demands of some settings). The presentation is going to show the results of our analysis in detail.