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Regional dynamical downscaling for urban environment to estimate the potential impact of climate change

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The RegCM regional climate model is designed to capture the regional meteorological processes with finer horizontal resolution than the global climate models, however, the scale of urban processes requires even finer scale, and definitely non-hydrostatic approach. Furthermore, in our target area, i.e. the Carpathian Basin, the built-up areas are not presented well enough (this is especially true for Budapest, the capital of Hungary). That is why to analyse the effects of climate change on urban environment dynamical downscaling should use finer scale and more complex terrain. In our model configuration, downscaling is carried out with the non-hydrostatic mesoscale Weather Research and Forecasting (WRF) Model, with updated surface databases, such as land use (with 5 urban surface categories), climatological albedo, topography, and spatial distribution of urban parameters. To execute the model, the initial fields needed by WRF are initialized using the RegCM (RegCM4.3) RCP4.5 and RCP8.5 output fields at every 6 hours on selected dates during three periods (past: 1971-2000; future: 2016-2045 and 2061-2090). Earlier studies showed that the frequency and the lifetime of heat waves are projected to last longer and be more intense, which causes further stress both for the human body and the environment. Based on these considerations, the WRF model coupled to multilayer urban canopy parameterisation was run only for the heat wave days in July from the aforementioned periods in the past and in the future, as well. In order to keep the stability of the simulations, the entire downscaling is carried out in several steps using gradually smaller domains embedded to each other. Thus, three embedded target areas have been determined for this modelling study, the largest external area covers the whole Pannonian region with 10 km horizontal resolution, whereas the innermost domain covers Budapest and its surroundings with 1 km grid resolution. Among the numerous derived fields those surface variables will be analysed, which have substantial impact on the thermal processes of urban areas. To estimate the heat stress change in urban environment during the 21st century the temperature differences between the urban and rural areas (Urban Heat Island, UHI) are also analysed.