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Regional dynamical downscaling with WRF model for the estimation of potential changes in urban heat island intensity in Budapest (Young Scientist Travel Award)

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Heat waves (HW) associated with climate change and increased near-surface air temperature can be considered as a climatic hazard for people (and the environment), especially in built-up areas, where the urban-heat island (UHI) phenomenon causes further heat stress for the human body. Such extreme events in the past and future can be analysed on the basis of regional climate model simulations with definitely finer horizontal resolution than the global climate models (GCM), however, downscaling over very complex terrains – like urban areas – needs special attention and even finer scale. The non-hydrostatic WRF (Weather Research and Forecasting) model is applicable for dynamical downscaling from 1.25° (GCM) to 1 km with gradually smaller embedded domains. In our configuration the initial and boundary condition fields needed by WRF are provided from the output fields of the RegCM regional climate model (RegCM4.3, 10 km resolution) simulations using historical, RCP4.5 and RCP8.5 scenarios for the Carpathian Basin. The analysis focuses on the potential effects of climate change on UHI intensities on selected HW days and on selected background cases in summer and winter during three periods (past: 1971–2000; future: 2016–2045 and 2061–2090). The possible changes in heat stress in urban areas caused by HW episodes compared to average climatological days can be estimated for Budapest with the 1 km resolution simulations using the WRF model coupled to multilayer urban canopy parameterisation. Among the numerous derived fields those surface variables will be analysed that are connected to the thermal processes in urban areas and the UHI. The ultimate aim of this study is to estimate the potential changes of UHI caused by climate change over Budapest, which can assist to develop local/regional adaptation and mitigation strategies.