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Future climate scenarios of urban heat stress in Vienna

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The urban heat stress in Vienna shows significant increase in the past decades which is expected to continue in the future due to the warming trend in the regional climate and urban area expansion. This study is intended to evaluate possible future changes in urban heat stress in Vienna taking into account regional climate projections and urban morphology. We apply the dynamical urban climate model MUKLIMO_3 to simulate the local scale circulation based on high resolution topography and land use data. The model simulates daily cycle of temperature, wind and relative humidity in the urban area after being initialized by mean atmospheric conditions from a reference station outside of the city. The cuboid method is used to calculate climate indices given the long-term timeseries of meteorological parameters from a reference station. As alternative to observational timeseries, we use regional climate model results to represent the background climatic conditions. We compare the mean number of summer days in Vienna for the periods: 1971-2000, 2021-2050, 2071-2100. The analysis includes an ensemble of regional climate projections for different IPCC scenarios: A1B, B1, A2 which have been downscaled by a set of regional climate models. We use currently available regional climate simulations covering Austrian region with a spatial resolution varying from 10 to 25 km from recent research projects: ENSEMBLES, REMO-UBA, CCLM Consortium, Austrian national project reclip:more. The employment of the urban climate model and the cuboid method brings clear improvement in simulating the thermal structure of the urban heat island in Vienna and its development compared to the regional climate models. We find very good agreement between simulated spatial distribution of maximum temperature with observational data. However, the future urban climate projections depend crucially on the trends imposed by the background climate and we find a limit to the applicability of the current regional climate simulations to estimate the future climate signal in the urban area.