Towards providing high-resolution forecasts to improve the existing heat warning system in urban areas - a case study based on urban climate simulations of Vienna

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Due to the negative impacts on human health and wellbeing, extreme heat load has recently been recognized as a significant threat to the environment and society. In state-of-the-art operational heat warning systems the meteorological information relies on the weather forecast from regional numerical models and monitoring stations, and hence does not include details of urban structure. In this study, the potential of high spatial resolution urban climate model simulations applied in weather prediction mode to provide detailed information of the thermal environment as an added value for the existing heat warning system is illustrated for the city of Vienna, Austria. For this purpose, the dynamical urban climate model MUKLIMO_3 of the German Meteorological Service (DWD) was coupled with the hydrostatic ALARO numerical weather prediction model to simulate the development of the thermal environment on a day-to-day basis. The aim was to evaluate the performance of the urban model, which take into account heat and momentum fluxes and radiation balance in building environment and was so far applied only for climatological studies, in weather prediction mode. The model simulations have been carried out on a horizontal resolution of 100 m and provide hourly outputs of parameters such as temperature, humidity and wind characteristics. The model results show good agreement with the hourly observations, especially at the urban and suburban stations where the mean bias is found to be low. The information obtained in this study can be used to support the development of urban planning strategies and to improve existing practices to alert decision-makers and the public to impending dangers of excessive heat.