Evaluation of MUKLIMO_3 urban model simulations for summer days in Vienna in 2011-2015

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The dynamical urban climate model MUKLIMO_3 of the DWD (Deutscher Wetterdienst) is used to simulate the development of the Urban Heat Island in Vienna in the summer period 2011-2015. The aim was to analyze the model performance when applied in the NWP mode and to evaluate the model applicability for improvement of the existing heat warning systems for the urban areas. Single day simulations with the MUKLIMO_3 model are conducted, initialized with the vertical profiles from the archived daily forecast data of the ZAMG from the ALARO model run at 0600 UTC. Two model configurations with a horizontal resolution of 100 m and 200 m are compared. Only days with a potential excess in heat were simulated (observed $Tmax \geq 25°C$), resulting in about 400 simulations with a duration of 24 hours. The results for the temperature and humidity extremes are validated using the monitoring data from 15 weather stations in Vienna.

The model results for daily Tmax show good agreement with the observations, especially at the urban and suburban stations where the mean bias is low ($\Delta Tmax<0.5°C$). The best performance is found in the temperature range $27°C<Tmax<35°C$. On very hot days, the model underestimates the Tmax and high variability is found at lower temperatures. Minimum temperature is generally overestimated and has lower correlation with observational data. The evaluation of relative humidity during day-time shows good agreement with observations for very dry days, but high humidity values are strongly underestimated. The results of individual simulations are highly dependent on the input data from the meso-scale model, which results in large deviation from observations if the forecasted data are not representative for the given day. The model results with different horizontal resolutions do not show substantial differences.