



Validation and analysis of WRF-simulated summer urban heat island effect for Budapest

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Mesoscale Weather Research and Forecasting (WRF) model is designed to calculate the microscale urban processes via urban parameterisation. We improved the default surface characteristics of WRF using independent, reliable databases. Thus, it is expected to reproduce the urban heat island phenomenon over Budapest. In addition to air temperature, the model also calculates the surface skin temperature over the model domain covering urban and rural areas. For validation purposes the low number of stations within Budapest (where only 4 meteorological stations are operated by the Hungarian Meteorological Service) and its agglomeration area is insufficient, whereas satellite measurements provide good spatial coverage of surface temperatures with 1 km resolution. However, as far as the temporal resolution, satellites (Aqua and Terra) with sensor MODIS (Moderate Resolution Imaging Spectroradiometer) pass over the Carpathian Basin only four times per day, which certainly limits the validation. Our simulations are configured with two embedded domains. The innermost domain covers Budapest and its surroundings with 1 km horizontal resolution, so the simulated results compared to the satellite observations without significant information loss.

Our results show that the patterns of surface urban heat island intensities are quite similar to the observations, but the daytime and nighttime intensities differ. The average root mean square deviation between the simulations and observations is lower at nighttime compared to daytime, when the incoming shortwave radiation changes quickly.