



Modelling alteration of urban heat load in Vienna induced by urbanization

M. Zuvela-Aloise, R. Koch, A. Neureiter, and R. Böhm*

ZAMG - Central Institute for Meteorology and Geodynamics, Vienna, Austria (maja.zuvela-aloise@zamg.ac.at)

Urbanization enhances formation of the urban heat island. On an example of Vienna, we examine the relationship between the city growth and the urban heat island effect by modelling the spatial distribution of urban heat load based on the modified land use datasets. The simulations are carried out with the dynamical urban climate model MUKLIMO_3 (DWD) combined with the so-called “cuboid method” to calculate climatological indices using observational data from the last 30-year climatic period. Three sets of experiments are performed in which high resolution land use data have been varied between the current land use survey, reconstruction of historical maps dating to the early instrumental period and hypothetical urban structures referring to the potential future development of the city. The modelling results illustrate the complexity in spatial signal of urban heat load as response to the land use changes. As expected, modelling experiments demonstrate large expansion of excessive heat in former rural areas. However, the intensity of the heat load strongly depends on type of the land use modification, topographical location and interaction with the surroundings. The simulations based on the historical land use dataset indicate that the densely build historical centre could have been sufficient to induce a substantial urban heat island, although small in extent. Moreover, the intensity of heat load during the day in the city centre remains mostly unchanged despite the urbanization of the surroundings. Experiments of possible future urbanization of remote rural areas in flat terrain indicate limited range of influence on the surroundings. Topography, large water bodies or orientation to the prevailing wind direction might substantially modify the intensity of the heat load originating in the land use change.