

Cities in Climate Change: Modelling urban climate and possible heat load mitigation strategies for sustainable urban development

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Urban areas generate specific local climate characterized by the Urban Heat Island (UHI) effect which enhances heat load and health risks for the urban population. Future climate projections indicate further rise in global surface temperatures throughout the 21st century (IPCC, 2007) and a high probability of more frequent and severe heat waves in Europe. In order to assess climatic risks and define strategies for sustainable urban development accurate climate information on a local scale is needed. On an example of Vienna, we applied dynamical urban climate model MUKLIMO_3 (Sievers and Zdunkowski, 1986; Sievers, 1990) to analyse the development of the UHI and to evaluate efficiency of possible strategies to mitigate the excessive heat load. The model simulates daily cycle of temperature, wind and relative humidity in the urban area based on the orography and land use data with 100 m resolution and background weather conditions from a reference station outside of the city. The investigation is focused on the spatial gradients of temperature during potential summer day conditions ($T_{max} > 25^{\circ}\text{C}$) to identify thermally sensitive areas within the city. The model has been evaluated against climatological data from monitoring stations and mobile measurements taken on a multi-vehicle bicycle tour. Both model and in-situ measurements show strong gradients in temperature which can be attributed to the different land use and partially to the orographical characteristics. In combination with the so-called 'cuboid method' (Frueh et al, 2010), we calculate climatological indices using observational data from the last 30-year climatic period and possible future trends according to the regional climate model scenarios. Based on the reference simulation, we perform set of test simulations in which we investigate the role of orography, near-by elevated forest area and impact of planned large construction sites, as well as water and green areas in the city. The urban model results are expected to provide guidelines for the policy making in city management and to be integrated in the future urban development plans.