EGU24-229, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-229
EGU General Assembly 2024

The future changes in spatio-temporal distribution of urban heat load and factors that affect its variability

Zdeněk Janků[1,2], Petr Dobrovolný[1,2], Jan Geletič[3], and Michal Lehnert[4]
[1]Department of Geography, Faculty of Science, Masaryk University, Brno, Czechia
[2]Global Change Research Institute of the Czech Academy of Sciences, Brno, Czechia
[3]Institute of Computer Science of the Czech Academy of Sciences, Praha, Czechia
[4]Department of Geography, Faculty of Science, Palacký University, Olomouc, Czechia

Summer temperature extremes are increasing rapidly under the current global climate change. Urban environments are among those most exposed to temperature extremes due to the urban heat island, and these exacerbated conditions significantly affect human health and activities, making urban heat load one of the most fundamental concerns for people living in cities. Our research quantifies spatio-temporal changes in urban heat load in two Central-European cities (Brno and Ostrava, Czech Republic) in different geographical configurations. We applied the urban climate model MUKLIMO_3, combined with the cuboid method, to simulate recent and future distributions of four summer climate indices. The simulation results clearly indicate continuous climate warming and project a significant increase in the mean annual values of summer climate indices by the end of the 21st century, particularly in the built-up areas with a predominance of impervious surfaces. Both model simulations and in-situ observations confirm that the magnitude of these changes can differ significantly from city to city suggesting the distribution of urban heat load is not only influenced by climate change, but also by local geography and anthropogenic factors. To determine the causes of the differences in urban heat load variability, we applied land use/land cover configuration metrics and correlation analysis using various geographical factors. Our results show that a compact and less fragmented land use/land cover structure can significantly increase the urban heat load. Altitude also has a strong influence on the heat load pattern in complex terrain. Therefore, some cities are and may continue to be extremely vulnerable to adverse summer temperature extremes. We suggest that urban planners should take into account the current impact of land use/land cover structure on temperature conditions when designing effective adaptation measures to mitigate urban heat load.