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Modeling summer heat load in Zagreb due to climate change effect

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Changes in surface and atmosphere characteristics in urban areas can alter radiation, heat and water balance and generate excessive heat load in those areas. One of the associated consequences is higher temperatures in built-up areas compared to the rural surrounding, also known as urban heat island (UHI). Here, summer heat load in Zagreb, the largest city of Croatia, is investigated. Summer season is in the focus of the study, not only because it is shown that trend in summer temperatures in Zagreb is stronger compared to the winter one, but also as it is the season when intense and prolonged extreme weather events, like heat-waves, are likely to occur.

In this work, urban climate model MUKLIMO_3 with 100 m horizontal resolution is applied for a broader area of Zagreb. To explore the effect of climate change on the heat load, two separate experiments with the same land-use (corresponding to the current state of the city), but for different climate conditions are made. Daily data measurements for the period 1951–1980 are used as past climate, while 1981–2010 period represents the current climate conditions. Heat load is here estimated by a number of days with the maximum air temperature above 25 °C, i.e. by summer days. Both simulations indicated the lowest values of heat load in mountainous forest area accompanied by increased values in densely built-up regions and old city center. However, lower number of summer days is also found for green and blue areas within the city. The spatial pattern of difference in the number of summer days between considered periods is mainly influenced by orography with a much lower increase in the mountain area of the domain than in the lowland city region.