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Urban heat island intensity analyse based on surface and air temperature measurements in Budapest (Tromp Foundation Travel Award)

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More than 50% of the total population live in urban areas, where the built-up areas and the artificial surface covers modify the energy budget, radiation characteristics, and wind field. These modifications result in the specific urban climate. The system of Local Climate Zones (LCZ) was created for a simplified characterisation of the city structure. To determine the different LCZs geometry and surface cover properties are used, as well as thermal, radiative, and metabolic properties, that is why it is an ideal tool for the micro/mesoclimate analyses of the different parts of cities. In this study we used the LCZ map of Budapest, the capital and also the largest city of Hungary. Altogether seven LCZ classes are present in Budapest: four built types (LCZ 2: compact midrise, LCZ 5: open midrise, LCZ 6: open low-rise, LCZ 8: large low-rise) and three land cover types (LCZ A: dense trees, LCZ D: low plants, LCZ G: water).
The modified radiation characteristics and energy budget form one of the most important urban climate effects, the urban heat island (UHI). UHI can be defined as the temperature difference between the densely built-up city centre and the surrounding rural areas. To analyse the UHI intensity we used satellite data from MODIS (Moderate Resolution Imaging Spectroradiometer) sensor (surface temperature) and in situ measurements (air temperature).
We investigated the UHI based on surface temperature in the seven LCZ classes, which can be found in Budapest, and also the UHI based on air temperature in several selected measurement points of the city from different LCZ classes. Our conclusions clearly show that the highest surface and air temperature UHI intensities appear in the centre of Budapest, where LCZ 2 (compact midrise) class is found. If building density decreases then the surface UHI intensities also decrease. Moreover, negative surface UHI intensities occur in the vegetation-covered parts of the city (LCZ A: dense trees). These results will be used as validation for the analyses of the urban energy budget of Budapest.