Spatial structure of the Surface Urban Heat Island in summer based on Landsat 8 imagery in the Górnośląsko – Zagłębiowska Metropolis, Southern Poland

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Urbanization results in the increase of impervious surfaces build of materials with high heat capacity and low albedo. Therefore, urban areas heat up more than the surroundings, leading to the development of the urban heat island (UHI). The UHI intensifies the effect of global warming by increased intensity and frequency of heatwaves in the city. In summer, the UHI is considered a phenomenon hazardous for the life and health of city inhabitants. The problem of UHI has not been studied in the Górnośląska-Zagłębiowska Metropolis (GZM), which is the most populated area in Poland. This study aims to determine the spatial structure and intensity of the surface urban heat island (SUHI) in GZM and identify the areas exposed to the most intense heat island. The relationship between the type of land use and the SUHI occurrence was also studied. Four LANDSAT 8 images were converted to the form of land surface temperature (LST). Based on the mean and standard deviation of the LST the extent of the overall SUHI was determined without considering the type of land use. Based on the same method, three classes of SUHI intensity (standard, strong and extreme) were defined and distinguished within anthropogenic areas determined based on the Corine Land Cover 2018 classification of land use. The intensity of SUHI was defined as a difference between urban and non-urban areas. The relationships between various types of land use and LST were also examined. In GZM, SUHI has a structure of 'archipelago' rather than an 'island'. In each image, the highest LSTs were identified for industrial areas represented by Katowice Smeltery. The standard SUHI, defined as average LST +1 standard deviation (only within an anthropogenic area) accounted for 12.7% to 14.4% of the GZM area in individual years, which indicates a small temporal variability of its extent. The extreme SUHI was identified mainly for shopping and logistic centers, industrial facilities, or coal dumps. The intensity of SUHI ranged from 5 to 9 °C depending on the image and method of urban and non-urban areas delineating. The highest average LST was characteristic of the discontinuous urban fabric and industrial or commercial units. Water and forest areas had the lowest average LST. The discontinuous urban fabric and industrial or commercial units constituted more than 70% of the overall SUHI area.