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Surface temperature analysis of urban areas using MODIS measurements in the 21st century

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MODIS (Moderate Resolution Imaging Spectroradiometer) is one of the sensors on-board satellites Terra and Aqua. They were launched to polar orbit as part of the American NASA's (National Aeronautics and Space Administration) Earth Observing System in December 1999, and in May 2002, respectively. Sensor MODIS is capable of viewing the entire globe daily with 1 km spatial resolution. In this paper, measurements of sensor MODIS have been used to analyze the spatial structure of daytime and nighttime surface temperature of urban areas in Central Europe. Thus, urban heat island effect of large cities with more than 1 million inhabitants (Bucharest, Budapest, Warsaw, Vienna, Milan, Munich, Sofia, Belgrade, Zagreb), and the nine most populated cities in Hungary (Debrecen, Miskolc, Szeged, Pécs, Győr, Nyíregyháza, Kecskemét, Székesfehérvár, and Szombathely) have been compared. The results suggest that the UHI intensity detected in the selected Central European cities exhibits high variability. Monthly average values of the temperature differences between urban and rural areas range between 1°C and 6°C, the most intense UHI occurs in daytime in the summer period (May-June-July-August). Population of the cities (which is highly correlated with the industry) is the main factor of determining UHI intensity that is modified by orography.