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Peculiarities of urban heat island in Vilnius

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An urban heat island means that an urban area or metropolitan area is significantly warmer than its surrounding rural areas due to human activities. Vilnius is the capital and largest city of Lithuania, with a population of 590 000 as of 2022. The area is 401 km^2 and the density is 1392/km^2. The aim of the study is to determine temperature differences in Vilnius city and its suburbs based on daily average, maximum and minimum temperature data during 2012–2019 period. This work also determines the effect that cloud coverage, wind speed and atmospheric circulation has on temperature difference between Vilnius city and its suburbs. In this study data from Vilnius University automatic meteorological station and two automatic stations of Lithuanian Hydrometeorological service in Vilnius city suburbs were collected and analysed, such as daily and monthly temperature averages, maximum and minimum temperature averages, wind speed parameters, cloud coverage and atmospheric circulation data. Vilnius University automatic meteorological station is the only station which represents microclimate of Vilnius Downtown (was opened on March 23rd, 2012). The study found that the average annual air temperature in the center of Vilnius is on average 0.59-0.88 ° C higher than in the suburbs. The strongest heat island (0.91-1.44 ° C) is formed during the warm season (May-September), and the smallest differences in average air temperature are formed in January (0.12-0.21 °C). Based on wind and cloud data, their impact on heat island formation was assessed. The heat island that's formed in Vilnius city is dependent on wind speed, e.g., weaker winds cause a stronger heat island. Cloud cover does not have such a significant impact on the formation of the heat island in Vilnius, but the trend shows that higher cloud coverage may form a weaker heat island. In 50 % of cases, the strongest heat island is formed by anticyclonic atmospheric circulation, 30 % of cases – by cyclonic atmospheric circulation and 20 % – by small gradient fields.