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Local and non-local drivers shaping the Moscow megacity heat island: a study based on the dense official and crowdsourced urban temperature observations

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The presented study is devoted to the investigation of the spatial structure of the urban-induced air temperature anomaly, which is known as urban heat island (UHI), based on the example of Moscow megacity. Two different types of in-situ urban temperature observations are used in our study. Firstly, we use the data obtained from the networks of official weather and air-quality monitoring stations. These networks were significantly extended in recent years. Now there are more than 70 regular weather observational sites in the city of Moscow and its surroundings, which turns Moscow megacity to a promising place for the spatially-resolved urban climate studies (Varentsov et al. 2017). Secondly, we consider the opportunity of further extension of the observational dataset by involving crowdsourced weather data from the Netatmo network, which is the biggest network of citizen weather stations in Moscow. Now there are more than 800 Netatmo stations in Moscow region. Such amount of data opens new prospects for spatially-resolved urban climate studies, but requires an accurate filtering and quality control of data from these citizen observations (Meier et al. 2017).
Using the both types of temperature data, we have found that the UHI spatial structure is driven both by local and non-nocal drivers. The local drivers are strongly linked with such predictors as impervious area fraction, Local Climate Zone (LCZ) type and building density, while the non-local drivers represent the influence of the whole city, transformed by the diffusion and advection. The non-local effects are reflected e.g. in the dependence between the UHI intensity and the distance from the city center; in the differences between similar LCZs, located in the different parts of the city; in the heat advection to the leeward side of the city. These findings of the study clearly illustrate the importance of taking the non-local effects into consideration in urban planning applications, biometeorological assessments and when applying the LCZ approach for big cities.

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