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Multiannual simulations of urban heat island over Bucharest (Romania) using WRF modelling system

Sorin Cheval (1,2,3), Liviu Oană (2), Alexandru Dumitrescu (2,3)

(1) "Henri Coandă" Air Force academy, Brașov, Romania, (2) National Meteorological Administration, Bucharest, Romania, (3) Research Institute of the University of Bucharest

The warming trend observed in the last decades in the Southern part of Romania has increasingly challenged various ecosystems and business. Wherever expanding urbanization occurred, the warming is intensified. Monitoring and predicting the impact of heat events in cities can be difficult due to insufficient systematic meteorological networks and surface heterogeneity, so that climate modelling is an appropriate tool to address such shortcomings. The urban heat island (UHI) effect over Bucharest (Romania) was simulated using the Weather Research and Forecast (WRF-ARW) model, using an urban canopy model (UCM) physical parametrization scheme at a grid point resolution of 0.9 km, and 1-h temporal resolution, for the period December 2014 – August 2017.
This study used the WRF model run on an Azure Infrastructure to downscale existing reanalysis products (i.e. NCEP/NCAR datasets) with a grid-point of 1 km-resolution which can capture the details needed to understand the UHI properties and the linkage with other applications. The main outputs of the research refer to: (1) the first analysis of the Bucharest UHI (BUHI) using integrated observed and modelled data over a multiannual period (2014-2017); (2) report on quantitative relationships of the BUHI to its main drivers, especially land cover and atmospheric dynamics; (3) report on the methodology describing the steps and the results of our research, including hints, difficulties, and required computation facilities.
The WRF outputs were compared with observed temperatures from nine urban and peri-urban meteorological stations, and the results demonstrate that the WRF model can be successfully used to simulate the BUHI. The differences between the two hourly datasets range between -1° and 1°C in 50-60%, and between -2° and 2°C in more than 80% of the situations. The study presents seasonal and daily scale results.