Geophysical Research Abstracts
Vol. 20, EGU2018-6644, 2018
EGU General Assembly 2018

Influence of land-use representation on atmospheric modeling over the urban areas: example of WRF simulations for Krakow region.

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Land-use representation has significant influence on near-surface atmospheric phenomena. It determines near-surface sensible and latent heat fluxes, radiation budget, atmospheric turbulence, planetary boundary layer and processes of cloud and fog formation. It is therefore crucial to properly define land-use category and terrain orography in atmospheric models as realistic as possible, especially in high resolution simulations.

For this purpose we have adapted 100mx100m Corine Land Cover (CLC 2006) database [1] to Weather Research and Forecasting (WRF) atmospheric model using reclassification methodology from Pineda et al. 2004 [2] and 3”x3” Shuttle Radar Topography Mission (SRTM) [3] database for topography.
The main goal of this project was to observe individual features of the urban climate resulting from human influence on the environment using high resolution meteorological fields. In order to obtain high resolution maps, WRF nesting capability has been used. Main domain with resolution 12.5 km and two nested domains with resolution 2.5 km and 0.5 km respectively. The most nested model domain covers the area 100kmx160km including the Tatra Mountains and Polish Uplands. To examine how the model works for different atmospheric conditions four simulations representing different seasons were performed. Simulations results were compared with measurements from 23 meteorological stations located in the urban area and suburbs of Krakow city. In order to verify the model, air temperature, humidity at 2 a.g.l, surface atmospheric pressure, wind at 10m a.g.l. and energy fluxes has been compared.

Simulation results confirmed thermal privilege of urban areas in relation to suburban areas (urban heat island) and also observation of the phenomenon of the flow of cold air masses to the valley which causes thermal asymmetry of this region.

This work was partially financed (supported) by the Faculty of Physics and Applied Computer Science AGH UST statutory tasks within subsidy of Ministry of Science and Higher Education.

References:
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