Simulations of Moscow agglomeration climate conditions with COSMO-CLM regional model, coupled with TEB urban scheme, for present and future climate

Mikhail Varentsov(1), Pavel Konstantinov(1), Timofey Samsonov(2), Kristina Trusilova(3),

(1) Lomonosov Moscow State University, Faculty of Geography, Department of Meteorology and Climatology, mwvare@gmail.com
(2) Lomonosov Moscow State University, Faculty of Geography, Department of Cartography and Geoinformatics
(3) Deutscher Wetterdienst, Department of Climate and Environment Consultancy

Motivation for research

- Idea of the research: To make a detailed climate forecast for Moscow city for XXI century:
  - for different climate change scenarios and for different scenarios of urban development
  - using regional climate model, coupled with specific urban surface model

Model setup, tuning and verification requires detailed understanding of modern climatic features:
- Quantitative parameters for comparison with model simulations;
- Qualitative description of local climate features and their behavior in different cases;
- Detailed investigation of Moscow megacity climate with usage the newest observation data
- Model verification for model climate

Moscow agglomeration climate: observation data

Available measurement sites for the summer 2014

Mean temperature anomaly, summer 2014

Mean day (sum) temperature anomaly DJ, summer 2014

Distribution of the temperature anomaly under different prevailing wind direction

Detailed spatial structure of Moscow UHI according to the newest observations

Mean summer temperature: no change in city planning

Mean summer temperature: radical city extension scenario

Simulation for future climate: the first experience

Summary:
- Specific features of UHI spatial structure, such as smooth temperature gradients between city center and its edges;
- Significant urban amplification of global warming in Moscow;
- Modelling experiments shows:
  - Selected configuration of CCLM-TEB relatively good simulates mean UHI intensity;
  - Diurnal variation of UHI intensity is inverted in model;
  - Model didn’t simulate expected effect of urban amplification of global warming even in case of very radical urban extension scenario;