EGU24-20040, updated on 23 Jan 2025
https://doi.org/10.5194/egusphere-egu24-20040
EGU General Assembly 2024

Dynamics and spatial distribution of air pollution over Minsk, Belarus as revealed by mesoscale and high-resolution urban WRF-Chem modelling

Siarhei Barodka, **Ilya Bruchkouski**, Nikita Kasushkin, Tsimafei Schlender, Piotr Silkov, and Tatiana Tabalchuk
National Ozone Monitoring Research Center (NOMREC), Belarusian State University, Minsk, Belarus (barodka@bsu.by)

This study is devoted to simulation of the Urban Pollution Island (UPI) phenomena over the urban territory of Minsk, Belarus and its surrounding area. We aim at recreating the common features of the air pollution spatial distribution and its time evolution on diurnal, week-long and seasonal scales. For that purpose we utilize WRF-Chem modelling system in nested runs using BEP/BEM urban parametrization schemes for the innermost high-resolution domains (500 m, 300 m, 100 m grid step). We employ two different approaches to urban morphology representation in the model (the Local Climate Zones methodology and direct representation of some of the urban parameters on the given model grid) and use ML-processed Open Street Maps (OSM) vector data and available remote sensing data to represent land use / land cover, buildings and streets parameters for Minsk urban territory and the surrounding area. A series of model runs is performed for time periods with various cases of meteorological conditions in different seasons of recent years. Anthropogenic emissions are specified for the Minsk area as several point sources (representing industrial emissions) and distributed sources over a network of main street and roads (representing vehicle emissions). By proceeding from national statistical data with estimates of main sources of atmospheric pollution in Belarus over the recent years, we formulate hypothetical distributions of emissions intensity over the specified sources and its temporal dynamics with diurnal and weekly cycles. Simulation results obtained with different configurations of the model, different weather conditions and different emission scenarios are compared to available observations: satellite remote sensing data, ground-based observations of air quality and meteorological parameters, vertical profiles of atmospheric pollution and meteorological parameters retrieved from MAX-DOAS and sodar observations.