Computer simulations of PM pollution in urban areas - some results for Sofia city

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Some extensive numerical simulations of the atmospheric composition fields in urban area (Sofia city) have been recently performed and an ensemble, comprehensive enough as to provide statistically reliable assessment of the atmospheric composition climate – typical and extreme features of the special/temporal behavior, annual means and seasonal variations, etc. has been constructed.

The simulations were carried out using the US EPA Models-3 system for 7 year period (2008-2014). As the NCEP Global Analysis Data with 1 degree resolution was used as meteorological background, the system nesting capabilities were applied for downscaling the simulations to a 1 km resolution over Sofia city. The national emission inventory was used as an emission input for Bulgaria, while outside the country the emissions were taken from the TNO high resolution inventory. Special pre-processing procedures are created for introducing temporal profiles and speciation of the emissions. The biogenic emissions of VOC are estimated by the model SMOKE.

The emissions in the used inventory were distributed over 10 emission categories (SNAP) and allow the evaluation of the contribution of various anthropogenic activities to the overall picture of PM pollution. The calculations are for 6 scenarios, which make it possible to evaluate the contribution of road transport, energetic, industrial and non-industrial combustions to the PM concentration fields in the city of Sofia.

The urban air pollution pattern is formed as a result of interaction of different processes, so knowing the contribution of each for different meteorological conditions and given emission spatial configuration and temporal behavior could be interesting. Therefore the "Integrated Process Rate Analysis" model option was applied to discriminate the role of different dynamic and chemical processes for the air pollution formation in the city.
Different characteristics of the numerically obtained PM concentration fields of as well as of determining the contribution of different pollution sources (SNAP categories) and different processes to the formation of surface PM concentrations will be demonstrated.