

ASSESSMENT OF THE CONTRIBUTION OF DIFFERENT PARTICULATE MATTER SOURCES ON QUALITY OF LIFE IN SOFIA CITY

Reneta Dimitrova, Faculty of Physics, Sofia University

❖ Description of the problem

The habitants of Sofia are unfortunately exposed to high levels of particulate matter (PM), despite a lot of efforts made by the municipality and the government in recent decades. A high resolution simulations using the Atmospheric Dispersion Modeling System ADMS-Urban were performed for one year (2014) with elevated levels of PM₁₀ (PM with aerodynamic diameter < 10 μm) concentration for the Sofia region, measured during the winter. Four main emission sources (point industrial, domestic heating, roads, and unorganized transport) were taken into account for this study. This works intends to evaluate the impacts of different sources on the air pollution and quality of life in Sofia city.

❖ Use of HPC Infrastructure

ADMS-Urban is a comprehensive system for modelling air quality and it is being used across the world for assessment studies of complex situations in urban areas and close to motorways, roads and large industrial areas (Figure 1).

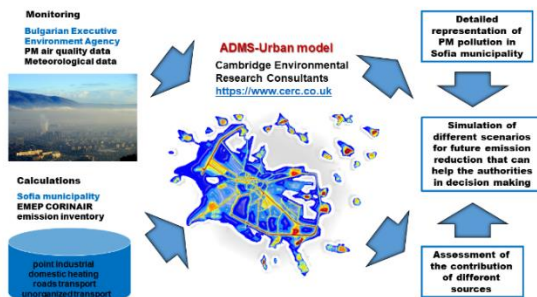


Figure 1. Schematic representation of the input and output flows to the ADMS-Urban model

The ADMS-Urban is applied to study the air pollution in local scales for first time in Bulgaria. The domain covers Sofia city and suburbs, approximately 38 km by 32 km, with grid resolution of 50 m, or almost half of million grid points. The simulations are performed for one year period and require a lot of computational resources. The results were obtained using PHYSON cluster at the

Faculty of Physics, Parallel Computer Centre (<http://physon.phys.uni-sofia.bg>).

❖ Main Results

- The contribution of the different types of sources to the modelled annual concentration, which is averaged over the entire domain, shows that the input of the domestic heating sources for all of the pollutants is most significant, followed by the contribution of transport from the main road arteries (Figure 2). The less notable contribution is from the point sources (below 2%).
- Considering the contribution of the different types of sources shows the substantial impact of transport (described as road—the main road arteries with heavy traffic, as well as the area transport sources from the minor roads in residential areas) on air quality in the central parts of the city, where the pollution is mostly local, in proximity of the source. The contribution of the domestic heating from wood and coal burning is highest in the city's outskirts and in the small towns in Sofia municipality.
- The locations of the maximal daily simulated concentrations during the year shows the formation of clusters, regardless of the various meteorological conditions. The city ring road and main boulevards with heavy traffic contribute substantially to the "hot spots" of the most polluted areas.

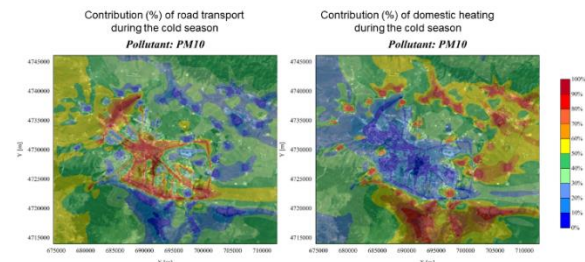


Figure 2. Contribution of different sources (in %) to the averaged concentration of PM₁₀ for road transport and domestic heating during cold season (November – March), R.Dimitrova et al. Atmosphere 2021, 12(4), 423; <https://doi.org/10.3390/atmos12040423>