

Results from research project – stage 1

<p>Contract No: Competition for financial support of basic research projects – 2021</p>
<p>Initial and final date of the project: Earth Science</p>
<p>Project title: <i>Development of a methodology for air quality and human health risk assessment in urban areas</i></p>
<p>Research organization: <i>Sofia University "St. Kliment Ohridski"</i></p> <p>Partner organizations:</p>
<p>Principle investigator: <i>Associate Professor, PhD Reneta Nedyalkova Dimitrova</i></p>

<p>Publication from the project</p>
<p>Burov A and Brezov D (2023) Transport Emissions from Sofia’s Streets - Inventory, Scenarios, and Exposure Setting. Lecture Notes in Networks and Systems, book series Environmental Protection and Disaster Risks, Editors Nina Dobrinkova and Orlin Nikolov, pp. 223-233; SJR 0.15 (2022), IF (2021-2022) 0.541, Q4 https://mg.phys.uni-sofia.bg/projects/AirQuality/2_EnviroRisk_ABurov&DBrezov.pdf</p>
<p>Velizarova M and Dimitrova R (2023) Impact of Regulatory Measures on Pollutants Concentration in Urban Street Canyon – A Pilot Study. Lecture Notes in Networks and Systems, book series Environmental Protection and Disaster Risks, Editors Nina Dobrinkova and Orlin Nikolov, pp. 203-2015; SJR 0.15, IF (2021-2022) 0.541, Q4 https://mg.phys.uni-sofia.bg/projects/AirQuality/3_EnviroRisk_MVelizarova&RDimitrova.pdf</p>
<p>Dzhambov A, Dimitrova V, Germanova N, Burov A, Brezov D, Hlebarov I, Dimitrova R. (2023) Joint associations and pathways from greenspace, traffic-related air pollution, and noise to poor self-rated general health: A population-based study in Sofia, Bulgaria. Environmental Research, SJR 1.64, IF (2021-2022) 8.876, Q1 https://www.sciencedirect.com/science/article/pii/S0013935123008794</p>
<p>Brezov D and Burov A (2023) Ensemble Learning Traffic Model for Sofia: A Case Study. Appl Sci, 13, 4678, SJR 0.49 (2022), IF (2021-2022) 3.095, Q2 https://doi.org/10.3390/app13084678</p>
<p>Dzhambov A, Dimitrova V, Germanova N, Burov A, Brezov D, Dimitrova R (2023) Road, air, and rail traffic noise and the prevalence of hypertension and diabetes in Sofia, Bulgaria: A population-based study. Proc of the 14th ICBen Congress on Noise as a Public Health Problem https://icben2023.com/papers</p>

Main results from the research project

Working packages (WP)

WP1 - A common database (including previously non-existent data) has been developed to be used in subsequent project activities and it will continue to be supplemented. The database is stored on a secure server of SU "St. Kl. Ohridski" with secured access for team members. The database will be provided for all interested Bulgarian Authorities and organizations after the completion of the project.

WP2 - An intensive review, reconciliation, and geospatial processing of a wide range of data were carried out and new information on specific sources (transportation, domestic heating, mud patches) previously missing was obtained. Models were developed to fill in missing data from various measurements by applying state-of-the-art methods, including machine learning algorithms, which made it possible to obtain a new inventory of emissions from road transport and domestic heating. A description of the algorithms and methods used was published in two high-impact journals and can be used by the scientific community.

WP3 - The weather forecast model was configured and validated after selecting the most optimal parameters to ensure reliable results under a wide range of meteorological situations. Results were obtained for the year 2018 (selected based on the amount of available data required for the developed emissions) and shorter periods in 2019 and 2020 used for specific tasks.

WP4 – Two stationary instruments for measuring the concentration of particulate matter (PM) was purchased and measured data were compared with 2 portable instruments, intended for use in the upcoming measurement campaigns. All preparatory activities for the installation of the equipment at both experimental bases have been completed. A methodology for conducting the epidemiological study was developed, including the development of a questionnaire form and training of interviewers. A representative quantitative survey was conducted among residents of Sofia (by the sociological agency Alpha Research, an external contractor) on their health status in relation to exposure to air pollutants and other characteristics of the urban environment. The data collected were used to derive exposure-response functions. A methodology was developed to sample participants from spatial clusters of addresses defined beforehand based on different combinations of relatively high and low levels of greenness, air pollution, and traffic noise. The results have been published in two papers, one of them in a high-ranking journal with an impact factor.

WP5 - The local air pollution model was configured and validated, and after simulations for 2018 the pollution from the major street network in the city of Sofia were obtained. With the developed emissions for 4 scenarios for low-emission zones in the central city, the fields of the main pollutants were obtained and the contribution of the different pollution reduction measures was assessed. The results have been published in an impact journal.