**DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)**

Aerosol chemistry has an important role in air quality and climate change. The link between cloud formation and aerosol is evident, however their direct and indirect effects are still poorly understood and parametrized. Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous and mainly related to anthropogenic emission. Atmospheric chemistry of lipophilic organic compounds such as PAHs is the main subject of many research campaigns, including ground-based observations and lab chamber studies. Polycyclic aromatic hydrocarbons originate from wildfires and combustion processes related to incomplete pyrolysis of organic matter, fossil fuel, traffic emission, etc. The scientific literature is focused on the 16 US EPA priority PAHs, such as low-molecular 2-ring (Nap) and 3-ring congeners (Ace, Acy, Ant, Phe, Flu) in gas phase and high-molecular weights 4-ring (Flt, Chry, BaA, Pyr), 5-ring (BbF, BkF, BaP), 6-ring (DahA, BghiP, IPy) that exist almost in the particulate phase. These congeners are characterized by different molecular structure (low-molecular and high-molecular weight PAHs), volatility, photodegradation rate, reactivity, affinity to organic ligands and reaction with gaseous pollutants.

The coastal regions are regarded as hotspots of various anthropogenic particles to the maritime atmosphere. The population of coastal aerosols, with marine and land components, is quite different in relation to the urban particles. Urban aerosol consists mainly of super-/submicron particles in nucleation/accumulation modes, including products of gas-to-particle conversion, combustion processes and traffic-emissions, whereas sea-salt particles are coarse in size and origin from bubble bursting. In the coastal regions, the contribution of low-molecular and high-molecular PAHs congeners to total particulate matter might be significantly different as a function of season and impact of emission sources. For example, the most recent modeling works of Efstathiou et al. (2016) pointed out that the ground-level concentration of BaP within the southern Baltic Sea domain is higher than observed at some other coastal areas (i.e. Mediterranean Sea).

So far, knowledge about the formation and removal processes of coastal aerosols in relation to polycyclic aromatic hydrocarbons (PAHs) within the Baltic Sea Environment, is incomplete and requires long-term measurements and modeling studies. For example, there is no data related to gas- and particulate-phase PAHs that underpins the development of their atmospheric budget and air-sea transfer of organic compounds. Here, we propose a series of field experiments focused on atmospheric PAHs chemistry, distribution, transport and environmental implications within the urbanized coastal zone of the southern Baltic Sea. Research tasks will include two fundamental aspects i.e. eco-toxicological and climatic. To our knowledge, core issues of this proposal are novel and has not been previously undertaken in Polish part of the Baltic Sea. We will focus on better understanding of factors controlling the gas-particle partitioning and seasonal distribution of parent-PAHs in the coastal atmosphere. We plan to incorporate data of reactive gaseous species ($O_3$, $NO_x$, $NO_2$, $SO_2$, CO) to assess heterogeneous chemistry and their influence on PAHs distribution in the coastal atmosphere. In addition, based on air temperature and relative humidity profile as well as pH value of particulate matter it will be possible to establish gas-to-particle partitioning of low-molecular and high-molecular PAHs in the ambient air. This mechanism is regarded as crucial for seasonal variability of PAHs in the atmosphere. The proposed PAHs-oriented project is also computationally intensive and will include multivariate statistical analysis, diagnostic ratios, local wind profiles and simulation of air mass trajectories derived from HYSPLIT model to give an insight into relationships between different emission sources (marine, local, regional/continental, trans-continental) and PAHs transformation over the coastal study domain. Based on results from HYSPLIT model it will be possible to assess the influence of marine boundary and mixing height on PAHs transfer from the atmosphere to the coastal ecosystem.

We plan to fully recognize the dominant sources and thermodynamic factors that control the variability of PAHs congeners in coastal aerosol. Results from this project will provide fundamental meaning for the synthetic evaluation of the biogeochemical cycle of PAHs congeners within the southern Baltic Sea region.