Atmospheric aerosols are one of the least understood climate shaping factors. According to the best current scientific knowledge aerosol generally cool the climate. On the other hand aerosols, especially those close to the ground, have a negative effect on human health. Because of their importance physical properties of aerosols are extensively studied by measurement networks with both national and international reach. Climatological effects of aerosols are dependent on the so called optical parameters that are usually studied with the use of remote techniques, both passive (sun photometers) and active with the use of lasers (LIDARs). In-situ techniques (e.g. nephelometers) also allow for studying optical aerosol parameters. The adverse health effects are usually studied with in-situ techniques, including measurements of particulate matter concentrations (PM10 and PM2.5), particle spectrometers and aethalometers that allow for estimation of carbon content in aerosol and chemical analyses of the collected samples.

Direct comparison between the results from remote and in-situ measurements is often difficult or impossible. Obtaining a complete aerosol profile requires the use of multi-instrumental measurements, combined with numerical techniques for data integration. These can be based on data assimilation into numerical models or multi-instrumental retrievals calculated by a dedicated numerical techniques. Despite these sophisticated techniques for measurement and data analysis being utilised the obtained results are often incomplete. This is due to the fact that measurements near the surface are being integrated with remote observations that are unable to retrieve information from the lowermost layer of the atmosphere, up to the altitude of 300 – 500 m.

In the project we propose multi-instrumental approach to profiling of atmospheric aerosol parameters. The currently used leading in-situ and remote techniques will be supplemented with measurements obtained with unmanned aerial vehicles (UAVs) in the first couple hundred meters above the Earth's surface. These measurements will be integrated with the use of advanced numerical techniques that will allow to obtain integrated physical properties of aerosols from in-situ, remote and satellite measurements. During the project the existing software will be modified so that the addition of UAV based measurements is possible. The development of the code will be possible thanks to a close international collaboration with the creators of these numerical techniques.

Three measurement campaigns in various orographic conditions are planned during the course of the project, these include coastal maritime, lowland and also hilly conditions in the depression between Carpathian and Sudetes mountain ranges (the so called Moravian Gate). This will allow for testing of the proposed techniques in different conditions. Moreover, the three campaigns configured with one superstation and two close by stations with basic equipment will allow for estimation of superstation's representativeness for its surroundings depending on local terrain type as well as studies of different measurement equipment configurations (used for obtaining complete profiles of aerosol optical and physical properties) in different terrain conditions.