This research addresses main challenges in the topic of hazardous anthropogenic air pollution that has a significant impact on human health and implies serious problems in land transport as well as aviation. Air pollution has become a public concerned problem in Poland. However, long-term data does not indicate deteriorating of air quality during last decade. We rather observe improvement of air quality similar, as in Western Europe, but rate of the negative trends leave much to be desired. This is particularly evident in autumn-winter period, when intensive haze events are observed. On the other hand, usually weather conditions during high aerosol concentrations favors fog development, which can reduce visibility to dangerous range. The impact of the aerosol on the physical properties of the fog is relatively poorly understood. Especially in the conditions prevailing in Poland during the cold season, when the transformation process between mist caused by light scattering by aerosol and fog is occurring in the short time scale and depends on hygroscopic growth and thermodynamic properties. Presented experimental and theoretical research focuses on physical phenomena occurring in the atmosphere during haze events (that are mainly caused by weather conditions and anthropogenic emissions from heating systems) and leading to particle activation, thus fog formation, its sustainability and dissipation. In particular, the aim of the project is to determine the influence of atmospheric aerosols, especially hydrophilic and strongly absorbing solar radiation particles, on fog microphysical, optical and radiative properties.

Under presented research, a construction of remotely piloted aerial system octocopter equipped with a custom-designed horizontally stabilized platform is planned for vertical profiling of the haze-fog radiative properties as well as microphysical and optical quantities. For radiation measurement payload must be horizontally stabilized for this purpose at during the project we will be developed dedicated stabilization platform, which afterwards will be integrated with multicopter on-board systems. Such system will be able to measure vertical profile of net radiation in haze and fog layers. The experimental studies will be carried out mainly at two stations, urban and rural, included in Poland-AOD research network. Both scientific sites consist of basic instruments required to measure radiation, aerosol optical properties and weather conditions. In addition, numerical simulations of radiative transfer, thermodynamical and dynamical processes undergoing in the haze-fog layer will be performed.

In this project, the research team will try to answer the following questions:

- what is the influence of absorbing aerosols and their vertical distribution in the lower troposphere on physical processes related to fog formation, development and disappearance?
- does the haze hygroscopic growth change the incoming longwave flux and radiatve forcing?
- is it justified to neglect absorbing coefficient variability due to change of relative humidity?
- what is the influence of aerosol concentration on fog depth, duration, and minimal visibility?

Obtained results of the project will improved the knowledge on haze-fog interaction. Authors believe that collected data may be useful in the future to parameterize aerosol physical processes in numerical weather models and allow improving the quality of fog forecasts. Current numerical weather prediction models are unable to predict fog accurately, partly because the macro and microphysical processes affecting the fog life cycle are still poorly understood. Also because of local nature of fog and the evanescent relations between the physical processes that govern its cycle, which must be parameterized in the models.