The influence of temperature inversion in boundary layer of atmosphere on air pollution

DESCRIPTION FOR THE GENERAL PUBLIC

The air pollution is one of the key problems in urban areas. Especially oppressive and health dangerous are episodes of high air pollution concentration accompanied by fog and air temperature inversions that prevent dispersion of the aerosols suspended in the air. Although the air quality has improved in the Upper Silesia Region (in comparison to the period of intense industrial activity before 1989) the episodes of especially high concentration of air pollutants still are occurring, particularly during winter season and are regarded as one of the most important problems in the most urbanised Upper Silesia Region. The development of air temperature inversion depends on weather conditions including wind speed, wind direction, air humidity, fog occurrence, radiation balance and precipitation. Atmospheric circulation described by direction of air advection, kind of pressure system (low or high), types of weather fronts and types of air-masses are also of a great importance. We assume that these factors determine depth (distance between the ground and the top of inversion) and intensity (rate of air temperature increase with height) of air temperature inversions that further influence the concentration of air pollutants. **This project aims at determining the significance of air temperature inversions for the distribution of air pollution in the Upper Silesia Region and its relation to weather conditions.** Research area covers the most urbanised and industrialised part of Poland and the most polluted region in Central Europe. The project is based on the meteorological data being continuously collected in Sosnowiec at the Faculty of Earth Sciences, University of Silesia in Katowice in the vertical profile of lower troposphere, i.e. at two heights: 2m and 100m above ground. These data are unique in the scale of Poland because the aerological stations (3 such station exists in Poland) are usually placed outside the cities. The measurements within the city border are usually done during short-term campaigns and do not allow the analysis of long-term changes and variability which will be studied in this project.

This project will:

- Assess the probability of air inversion occurrence with regard to its' intensity which, is assumed to be crucial for air pollutant concentrations,
- assess the spatial extent of air temperature inversions thus the role of local and over regional factors in their development
- determine the potential weather conditions (weather types) for development of air temperature inversion, together with episodes of high pollutant concentrations and smog in the "Sląsko-Zagłębiowska Metropolis",
- recognize the distribution of the organic pollution in the vertical profile of the lower troposphere and its relation to meteorological and synoptic conditions.

Moreover, the 21-year long chronological series of meteorological data allow analysis of trends and variability in air temperature inversion occurrence in the centre of the most industrialized part of Poland on the background of current rapid climate change. Some of the meteorological elements used in this study including humidity**, fog occurrence, radiation balance and precipitation have not been previously incorporated into research on air temperature inversion and their impact on air pollution in this region**, just like weather fronts and air masses. Apart from the freely available data on standard air pollution (PM_{10}, $PM_{2.5}$, NO_X, SO_2, O_3), the data on composition and concentration of organic pollutants (including organic tracers) gathered at the vertical profile of the lower troposphere in Sosnowiec will also be used for the first time.

Summing up, the project will deliver the results on the development and behaviour of the structure of lower troposphere depending on weather conditions in the centre of the most urbanised areas in Poland. **The analysis of the spatial extent of the air temperature inversions allow to assess whether the inversions are more triggered by local, urban conditions or by factors of an over regional scale** and therefore obtained results can be further used in the spatial planning and urban climate research.