Among the EU countries the concentration of PM in Poland reaches the highest levels, repeatedly exceeding the limit values. Reliable assessment of the concentrations of particulate pollutants in our country, that threaten both- population health and human life is therefore a key task. Research concerning PM "mass closure" indicates, that the measurement of the sum of all its chemical components does not correspond to its total gravimetric mass. The missing part of the weight can reach up to 40% and is mostly attributable to the presence of PM-bound water molecules. Diminishing the role of water in shaping the PM concentrations may result in demonstrating the exceedance of PM levels, even in the situations, when the air quality meets the standards. At the moment, the role of PM-bound water is poorly understood. It is however known that the presence of water in PM particles is important not only for the correct measurement of its weight, but also for the understanding the chemical transformation leading to the particles nucleation, formation of secondary aerosol or clouds. The PM-bound water occurs in two main forms – weakly and strongly bounded to its chemical structure. The weakly bounded water undergoes dynamic fluctuations due to the changes in the air relative humidity, while the water bounded by molecular forces - the so-called constitutional water, maintains on a relatively constant value over the particles lifetime. That permanent water bonding by the individual PM compounds, suggests that the particles originating from the same source have similar water contents. That is why, the identification of the probable sources of PM by looking the similarity in PM-bound water spectra between the source and the receptor site is currently possible. Presented hypothesis assumes that areas subjected to anthropogenic emission, where the predominant share of the PM mass consists of highly hygroscopic secondary organic aerosol and inorganic ions such as $(NH_4)_2SO_4$ $(NH_4)NO_3$ are characterized by much higher amounts of PM-bound water compared to areas dominated by the PM of natural origin, rich in weakly hydrophilic mineral particles and crustal matter. Literature data indicate that water sorption by PM particles collected in urban and industrial areas correlate with an increase in IR absorption, which indirectly influence the regional climate, promoting more intense rainfall.

The main objective of the project is to quantify the amount of PM-bound water and to use this parameter as a tracer of its origin.

The methodology proposed in the project is based on the examination of the evaporative spectra of two PM size fractions collected in two different receptor sites (characterized by different emission profiles) and at the same time in source sites affecting those receptors, and further to use the CA (cluster analysis) and PCA (principal component analysis) to demonstrate similarities and differences in the amount and type of water in the source-receptor manner. The analyzes will be carried out by means of Karl-Fischer coulometric titration with a different ramp temperature regimes. The obtained results from the one hand will demonstrate to which extent the aerosol water might affects the PM gravimetric determinations, and on the other hand will help, to answer the question of whether the content of constitutional water (permanently bounded to the PM chemical structure) can be used as a tracer of PM origin. The influence of meteorological parameters, mainly rainfall and relative humidity on the quantity and variability of PM-bound water occurrence will be also determined.

If the stated hypotheses find to be truth, the obtained results, conclusions will enable to use atmospheric water as a marker of PM origin and to better understand the processes to which aerosols are subjected in the atmosphere.