There is a strong scientific evidence that atmospheric water influence gravimetric measurements of particulate matter (PM) and therefore its concentration level. Both primary and secondary aerosols particles can be hygroscopic and due to the contact with water vapor change their chemical and physical properties. The presence of PM-bound water provokes a rethinking of SOA formation, partitioning of semi-volatile compounds, heterogeneous chemical reactions occurring in the atmosphere, cloud condensation, or even their atmospheric lifetime. My recent work strongly suggests that particles of different origin possess unique properties regarding hygroscopicity and those properties can impact aerosol processes all the way, up to the global scale. Because of the crucial role of atmospheric water on the precision and repeatability in mass measurements of PM the gravimetric instruments development as well as studies regarding the conditions during weighing in the laboratory and during PM sampling are needed. Gravimetric mass of PM continues to be an important surrogate of regulatory importance linking particulate pollution to health and environmental impacts. For this reason methods of PM measurement have become essential in the preparation of strategies directed to human health protection. Filter weighing is a key part of this process, since PM mass and its concentration give a measure of air quality. Next to the manual weighing a robotic weighting systems have been developed to catch even microgram-level PM mass. In comparison to traditional weighing these systems provide more repetitive and accurate results regarding PM mass and eliminates human factor as the reason of measurement errors, making them more cost-effective and compliant with the EN 12341:2014 standard. This project will give an evaluation of the performance of a traditional manual weighing vs robotic weighing in the repeated measurements of mass as a comparative measure. To the date a coherent scientific view of the effects of PM-bound water on uncertainty in mass measurements has yet to be established. In this research I will define the uncertainty in gravimetric measurements of PM due to water species occurrence, and finally find out to which extent this uncertainty can be reduced to get most precise mass results. Different PM fractions (PM_1, $PM_{2.5}$, PM_{10}) will be collected in three locations differing regarding the type of emission sources. The reference samplers will be used. To know, whether and to which extent filter type influence deviations in weighing precision different types of filter media will be used. The PM mass will be measured with a typical microbalance and newly developed weighing robot. The impact of the weighing technique on the deviations of PM mass measurements will be determined. An influence of the particle mass loadings collected onto filter on the accuracy of the gravimetric measurements will be also determined. The ultimate goal of this study is to obtain a better understanding of mechanisms regulating variation in mass of particulate matter due to atmospheric water content as well as the impact of this uncertainties on human health, when determining PM concentration. The main objectives are: 1) To develop new procedure of weighing suitable for quantification of a mass of non-exposed filters used for PM collection as well as particles mass characterized by the highest precision 2) To evaluate hygroscopicity of different materials used for PM collection and 3) kinetic limitations related to the up-take of water vapor by PM particles. This project will get us closer to the understanding of the effects of PM mass and its size fractionation on water uptake by particles in sub- and super-saturated conditions as well as physical and chemical properties of PM standing behind the weighing precision. The project will combine laboratory experiments, field observations and instrumentation development to: a) explain the chemometric mechanisms behind RH-dependent particles water-uptake with changes in PM mass; b) show that laboratory data regarding PM hygroscopicity and checking whether the PM-bound water speciation in the receptor is specific for the source; c) demonstrate the repeatability in the PM mass measurements dependent on PM-bound water-affinity. We conclude that the commonly-used single-parameter – "the effect of humidity on particulate matter" can introduce significant error when quantifying the environmental and health effects of aerosols. We hypothesize, that robotic weighing systems are better able to minimize temperature and relative humidity [RH] fluctuations in the weighing environment and therefore allow for more precise determination of the levels of PM in the air. Thanks to the usage of those systems is will be possible to obtain more reliable information about possible exceedances of PM, which information is of great importance.