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Relative humidity, precipitation and fog influence on SMPS spectra

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Atmospheric aerosol particle size distributions (PSD) have been studied due to the contribution of aerosols to climate radiative forcing, aerosol – clouds interactions, atmospheric visibility reduction, and human health effects etc. (Kerminen et al 2005; IPCC, 2007; Wichmann et al, 2000). On the other hand, strong feedback mechanisms of the atmosphere on aerosol have been found as well. For example, cloud processing and wet deposition, some of the most discussed aerosol-related meteorological topics nowadays, both considerably influence the aerosol PSD.
This work describes the first results of categorization of aerosol PSD according to various meteorological conditions - relative humidity, precipitation and fog events. The data were collected during the first 22 months of measurements from 05/2008 to 02/2010 at Observatory Košetice located in the Czech Highlands (49°35'N, 15°05'E, altitude 534 m). This background station, operated by the Czech Hydrometeorological Institute, specializes on environmental quality monitoring but is also a part of the national professional meteorological measurement network. In 2008, the observatory became a part of the EUSAAR network and was equipped by the IfT-SMPS run by ICPF.
The SMPS was sampling every 5 minutes over mobility size range from 9 to 900 nm. Data were averaged into one hour intervals and results were compared to the standard meteorological data (RH, precipitation amount and temperature) and professional observer's records. The records were taken in one hour time resolution, describing the character of weather at the station and types of precipitation. Then, typical SMPS spectra for individual phenomena were derived.
For very dry conditions, bimodal distributions is usually found. With the growing RH, particles under 50 nm in diameter is most effectively removed or grows into the accumulation mode. Above 60% RH, the accumulation mode particles' concentrations increase, reach maxima around 80 % RH, and then the concentrations start to drop again.
During foggy days, no bimodal distributions have been recorded. Moreover, the concentrations have been well below average. For the vertical hydrometeors, the shape of PSD depends strongly on the type of hydrometeors and their combinations as well.

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