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Effects of water uptake on the aerosol light-scattering coefficient at Montseny, western Mediterranean

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Atmospheric aerosol particles are key components of the Earth's atmosphere affecting the energy balance and consequently the global climate. Microphysical and optical properties of aerosol particles are strongly dependent on the relative humidity (RH). Knowledge of the effect of RH on aerosol optical properties is of great importance for climate forcing calculations and for comparison of in-situ measurements with satellite and remote sensing retrievals. This RH-effect on the scattering coefficient can be quantified through the scattering enhancement factor, f(RH), that is defined as the ratio of the scattering coefficient at a high and at a reference RH (typically <40%).

In this study we present long-term results of f(RH) measured at a regional background site in the western Mediterranean, Montseny (MSY, 41°19'N, 02º21'E, 720 m a.s.l.). The MSY station is located in the Montseny natural park, 40 km to the N-NE of the Barcelona urban area, and 25 km from the Mediterranean coast. The station is located on the upper walls of a valley extending perpendicularly from the Catalan Pre-Coastal ranges, in a densely forested area. The station is situated relatively far from urban and industrial zones, but the region is densely populated and heavily industrialised, and anthropogenic emissions can affect this site under specific meteorological conditions. At this station, a hygroscopicity nephelometer tandem is used for measuring the scattering coefficients at dry and wet conditions. In the humidograph the RH is scanned from <40% up to 85-90% and back to <40% every hour. Ancillary measurements routinely performed at the MSY station such as the particle number size distribution (fine and coarse) and aerosol light-absorption coefficient are also used in this study. In addition, during part of the measurement period, there are co-located measurements of online chemical composition of submicron aerosol measured with an ACSM (Aerosol Chemical Speciation Monitor, Aerodyne Research). Here, we investigate the seasonal and diurnal variability of f(RH) in relation to the predominant aerosol type according to air mass classification, chemical composition and mean aerosol size.