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Characterization of particle-droplet interactions in wintertime fog in Hungary: results of an intensive monitoring campaign

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Intense air pollution episodes regularly occur during the winter months as a result of the complex interplay between the emission of air pollutants and adverse meteorological conditions. Under strong stable air, horizontal and vertical mixing are limited due to the development of a thermal inversion layer; consequently, fog formation is a frequent accompaniment of severe smog episodes. In Hungary the formation of these strong stable atmospheric conditions is further aggravated by the unfavorable topography of the Carpathian basin leading to particularly lengthy and severe episodes.

In this work we summarize our results on the characterization of fog events during a wintertime intensive monitoring campaign. This campaign was carried out on a rural site near Lake Balaton (Hungary) between October 15 and December 13, 2018. The sampling site was characterized by features conducive to local fog formation and was also impacted by local pollution from home heating in the region. The monitoring program was carried out using various instruments including optical particle counter (OPC), Single-Column Cloud Condensation Nuclei Counter (CCNC), fog water collector, meteorological instrumentations.

We present detailed analysis of the period of November 3–12, 2018 during which 6 fog formation events were observed. We interpret the dynamical processes of fog formation from the aspect of atmospheric aerosol and water vapor interaction. The evolution of fog together with the variation of aerosol characteristics is studied with high time resolution. During these events the variations of aerosol number concentrations and size distribution are studied as a function of relative humidity and available water vapor concentration and other meteorological parameters. The rate of water uptake by the particles and the hygroscopic mass growth of PM10 and PM2.5 are also estimated and the temporal variation of activated CCN concentration as a function supersaturation is discussed. The work contributes to better understanding of the complex interactions between aerosol particles and atmospheric water in dynamic microphysical processes of fog formation and dissipation.