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Insights into PM1 during haze episodes in Beijing, China, using an aerosol mass spectrometer in a two-month winter field campaign 2016

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Atmospheric aerosol impacts the climate system by absorbing and scattering light (direct aerosol effect) and by serving as cloud condensation nuclei (indirect aerosol effect). Furthermore, high atmospheric aerosol loadings are detrimental for human health.
Within the last decades aerosol mass concentrations have been observed to reach up to several mg/m^3 in the eastern China plain, strongly influencing the air quality in densely populated areas and megacities like Beijing [1]. Meteorological conditions have been shown to be a very critical parameter for the emergence of haze episodes and the subsequent cleaning of the air [2]. As most of the studies were performed between spring and autumn, there is still a lack of understanding of wintertime processes [3,4].
For this study particle- and gas-phase data have been collected at a rural site northeast of Beijing city (40°24'31.4"N 116°40'52.1"E) in January and February 2016 within the framework of the University of Chinese Academy of Sience (UCAS) winter campaign of Beijing University and Forschungszentrum Jülich. This abstract focuses on the Aerodyne aerosol mass spectrometer (AMS) dataset.
The measurement period can be subdivided in two prevailing conditions. Firstly, periods with northerly winds, when air masses were very clean in respect to both gas and particle phase only influenced by local sources from the closeby villages. Secondly, conditions of southerly winds, when haze was transported to the field station. During haze episodes PM1 levels of up to 350 μg/m^3 have been observed and the fraction of nitrate increased from 8 % to 25 %. This increase happened at the expense of organics which decreased from 68 % to 44 % while still being the largest contribution to PM1.
Application of unconstrained Positive Matrix Factorization (PMF) on the organic mass spectra showed contributions from coal-combustion and biomass burning, both strongly correlating with allocated offline PAH analysis. In addition, a hydrocarbon like factor and two oxidized organic aerosol factors (OOA) were identified. The coal combustion and biomass burning factors as well as the hydrocarbon like factor were mainly found from local emissions while the oxidized factors showed highest contribution during haze conditions. Causes of the increase in OOA and nitrate during periods of haze will be discussed.
Understanding atmospheric chemistry under extremely polluted conditions is a major challenge to develop mitigation strategies. This study exhibits new insights into changes in aerosol composition for clean and haze episodes in rural Beijing during wintertime assisting to identify key processes.

[1] Zhang, R. Y. et al., 2015, Chem. Rev., 115, 3803-3855
[2] Zhang, Z. et al., 2016, Atmos. Chem. and Phys., 16, 561-571
[3] Wang, Q. et al., 2017, Atmos. Chem. Phys. Discuss.
[4] Zhou, W. et al., 2017, Atmos. Chem. Phys. Discuss.