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Assessing the factors related with winter haze events in Europe and Asia

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Organic aerosol (OA) is a large fraction of total particulate matter, either directly emitted into the atmosphere (primary) or formed in air by oxidation processes (secondary) of gas precoursors (Jimenez et al., 2009). The aerosol's climate and health effects are strongly influenced by the chemical composition of OA and hence by the contributing emission sources and formation processes (Cassée et al., 2009). Thus examining sources and their contribution in different regions during severe pollution episodes is important for designing effective mitigation strategies. Such analyses require measurements capable of quantitatively distinguishing OA sources, distributed over a broad spatial scale with sufficient spatial density to capture regional differences.
Aerosol mass spectrometer (AMS, Aerodyne) measurements of OA and subsequent application of positive matrix factorization (PMF) quantify the contribution of different primaries as biomass burning (BBOA), traffic emissions (hydrocarbon-like OA, HOA), and cooking (COA) and also secondary oxygenated OA separated by their volatility (semi-volatile: SV-OOA and low-volatile: LV-OOA) (e.g. Lanz et al. 2007). However, the systematic deployment on a dense network to determine regional differences is hindered by the instrument cost and intensive maintenance. To overcome these limitations, we have developed a method for the analysis of conventional aerosol filter samples using high-resolution AMS measurements. Such samples are relatively easy and inexpensive to collect and store, and are already routinely collected worldwide.
The analysis method consists of water extraction of the particulate material from quartz filters and subsequent atomization of the resulting solutions into the AMS. The recovery of organics is estimated as $\sim$70% and the mass spectra obtained by this methodology are comparable to the corresponding online measurements for different seasons.
We present the application of this technique to filter samples collected at different sites in Switzerland and China during winter-time haze events. Data are analysed with the multilinear engine ME-2 (Paatero 1999), and in combination with markers improved estimates of source contributions are obtained. Mostly secondary OA make the largest proportion of OA during winter haze episodes. Primary sources include wood, traffic, cooking in Switzerland, while coal contributions are additionally found in China. Also dust related organic aerosol is only found in China. Source contribution and emission profiles at different stations will be discussed and related to the prevailing meteorological and combustion conditions for both regions.

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