AMS and Radiocarbon coupled source apportionment of carbonaceous aerosols during one year in Magadino

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Carbonaceous aerosols constitute of a major fraction of the ambient particulate matter (PM) (Jimenez et al., 2009). They are often classified into: Elemental Carbon (EC) that is directly emitted into the atmosphere (primary) and Organic Carbon (OC) that may be either primary or secondary, which is formed in the atmosphere via oxidation of volatile organic compounds from fossil and non-fossil sources.

The deployment of the Aerodyne aerosol mass spectrometer (AMS) and the use of positive matrix factorization (PMF) have significantly enhanced our capability to identify these sources. While such techniques are ideal to separate primary sources such as traffic, cooking and biomass burning (BBOA) from secondary oxygenated organic aerosols (OOA), the precursors of the latter remain typically not accessible. Meanwhile, radiocarbon (^{14}C) analysis provides an unequivocal distinction between fossil and non-fossil sources which in combination with AMS/PMF plays a crucial role in the investigation of SOA origin.

Magadino, like many rural background sites in the alpine valleys, suffers from extremely high contribution of carbonaceous aerosols during winter (Gianini et al., 2012, Zotter et al., 2014). Our preliminary results indicate that biomass burning contributes up to 80% to the total organic aerosol during winter (Figure 1). Traffic and cooking show very low relative contributions, whereas secondary sources (OOA) separated according to their distinct seasonal behaviour (summer and winter) remain a major source of OC even at such locations.

As a general air quality issue for locations such as Magadino is being raised, detailed knowledge of the most important carbonaceous sources is required. While previous studies (Zotter et al., 2014) at such sites have mainly focused on the most polluted events, little is known about the air pollution seasonality and the influence of different sources thereon. Here, we combine for the first time to the best of our knowledge, year-long Offline-AMS (Daellenbach et al., in prep.) and radiocarbon measurements conducted in Magadino. The quantified contributions of anthropogenic and biogenic emission sources to primary EC and OC and secondary aerosol precursors will be presented.

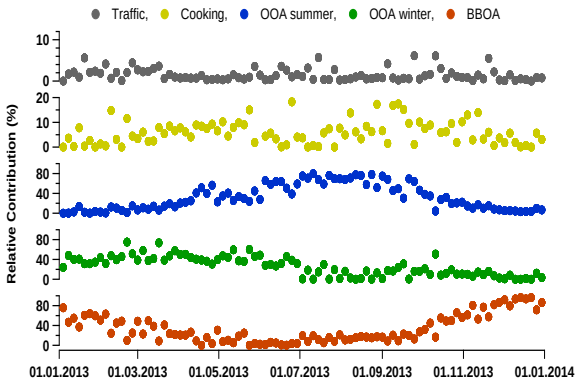

Figure 1. PMF results from filter measurements with the High Resolution aerosol mass spectrometer (HR-AMS) in Magadino, following the methodology described in Dällenbach et al. The results show the yearly cycle of five identified factors.

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Daellenbach, K.R., et al. (in prep.)
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