

Identifying the main sources of brown carbon in the atmosphere

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Atmospheric brown carbon (BrC) contributes significantly to aerosol absorption in the atmosphere, especially at lower wavelength. This fraction of the organic aerosol is composed of a large number of complex chromophores. The main processes by which these compounds are introduced in the atmosphere or formed through atmospheric oxidation remain virtually unknown and as a result, the contribution of BrC to atmospheric absorption is highly uncertain.

Here, using factorization techniques, we identify the main primary and secondary sources of water and methanol soluble BrC, at two urban sites in Switzerland over a yearly cycle. The same samples measured by UV/vis spectrometry for bulk absorption are analyzed using offline aerosol mass spectrometry for the identification of the main organic aerosol sources. The amount of humic-like substances on the samples was also determined. From these analyses, we will present estimated mass absorption cross-sections of different organic aerosol fractions, including primary biomass smoke, and wintertime and summer time secondary organic aerosol fractions (Figure 1).

We show that biomass burning, driving the concentration of humic-like substances, is the major source of BrC at both sites, during winter. In summer, the absorption due to brown carbon decreases significantly, suggesting that the organic aerosol, mostly related to SOA, is less absorbing. Through complementary smog chamber experiments, we investigate the optical properties of biomass burning emissions as a function of aging and assess the impact of BrC on the total absorption in different environments.

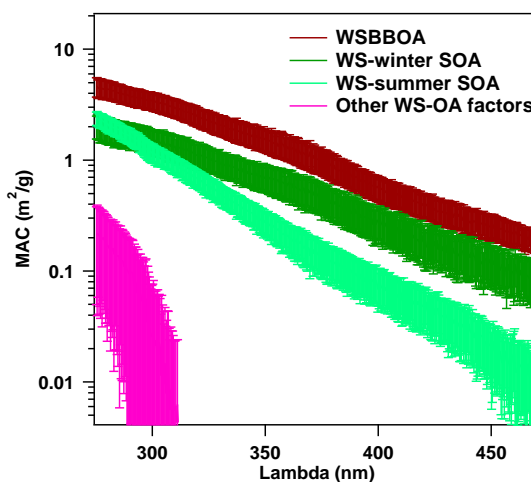


Figure 1. Comparison of the mass absorption cross-sections of the water soluble (WS) fractions from different sources that influence the organic aerosol at the two study sites. These sources include primary biomass burning, and wintertime and summer time secondary organic aerosols.

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