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Source apportionment of carbonaceous aerosols with radiocarbon

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Anthropogenic activities like fossil-fuel usage and biomass burning as well as natural processes like plant abrasion and secondary particle formation by atmospheric oxidation of biogenic precursors are identified as the major sources of the carbonaceous particulate matter. The importance of these different sources, however, still can not be estimated accurately. In contrast to other methods like emission inventory modeling and analysis of organic tracer compounds, radiocarbon (^{14}C) measurements of the carbonaceous aerosol offer the opportunity of a direct distinction of fossil and non-fossil sources. Due to its age, ^{14}C has completely disintegrated in fossil substances, whereas modern plant material is on the contemporary radiocarbon level. This intrinsic isotopic information characterizes the sources of ambient particulate matter independent of its history regarding emission conditions or atmospheric transport [Szidat et al., 2006].

In this work, we discuss the potential and the scopes of ^{14}C measurements in organic carbon (OC) and elemental carbon (EC) fractions of the carbonaceous aerosol for source apportionment. We present results from different sites in Switzerland and Sweden and show seasonal variations. The importance of biogenic SOA during summer and the impact of residential wood heating during winter are addressed.

Szidat, S., et al.: Contributions of fossil fuel, biomass burning, and biogenic emissions to carbonaceous aerosols in Zürich as traced by ^{14}C, J. Geophys. Res., 111, D07206, doi:10.1029/2005JD006590, 2006.