Source apportionment of carbonaceous aerosols using ^{14}C: Results from Europe and China

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Carbonaceous aerosols are a major fraction of particulate matter (PM) in the atmosphere and contribute substantially to climate and health effects. For mitigation of emissions, a detailed knowledge of sources and formation processes are necessary, which is a difficult task. A differentiation of fossil from non-fossil emissions is provided by analysis of the long-lived radioisotope ^{14}C (radiocarbon, half-life 5730 years), as fossil material does not contain ^{14}C anymore because of its age, whereas non-fossil material is on the contemporary ^{14}C level. This unique property qualifies ^{14}C as a powerful tool of source apportionment of carbonaceous aerosols.

Carbonaceous aerosols are often differentiated into organic carbon (OC) and elemental carbon (EC) according to their physical and chemical properties. For ^{14}C source apportionment, it is necessary to separate both fractions from each other efficiently in order to omit biases [1]. With this technique, traffic and wood-burning contributions were quantified for winter-smog conditions at 16 sites in Switzerland for 2008-2012 [2]. Such conditions typically stand out by PM concentrations above the Swiss pollution standard. ^{14}C analysis revealed that ~70% of OC and ~45% of EC originated from wood burning at this time, which is higher than expected. During extreme haze episodes in China in January 2013, when PM concentrations exceeded even those for the winter-smog conditions in Switzerland by up to an order of magnitude, EC was mainly emitted by coal burning and traffic (~75%), whereas the remaining ~25% was exclusively attributed to biomass combustion [3]. In this work, we will present further examples and implementations for air quality improvement.

[1] Zhang et al. (2012), *Atmos. Chem. Phys.* **12**, 10841-10856.
[2] Zotter et al. (2014), *Atmos. Chem. Phys.*, **14**, 13551-13570.
[3] Zhang et al. (2015), *Atmos. Chem. Phys.* **15**, 1299-1312.