Source Apportionment of Carbonaceous Aerosols based on High-Time Resolution Instrumentation

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Introduction

Carbonaceous aerosols account for a significant fraction of fine aerosol mass. The limited knowledge of organic aerosol (OA) types and sources, as well as the origin of black (BC) and brown (BrC) carbon, makes the reduction of this contribution a challenge.

The relevance of the need for this information is based on the negative impact on human health caused by exposure to aerosols and the impact on the climate and the environment. Within this framework, the main challenge of COST Action CA16109 COLOSSAL Chemical On-Line cOmpoSition and Source Apportionment of fine aerosoL is to consistently assess the spatial and temporal variability of fine atmospheric aerosols across Europe, their chemical composition, and sources, trying to understand the underlying processes.

Methods

As of March 2019, 76 institutions from 32 countries have joined their efforts within this Action. The instrumental advances in the last two decades, specifically the development of field-deployable aerosol mass spectrometers, fostered new research approaches regarding OA characterization. These include the Aerosol Chemical Speciation Monitor, which measures non-refractory ammonium, nitrate, sulfate, chloride, and high time resolution organic mass spectra (Ng et al., 2011; Fröhlich et al., 2013). The multivariate statistical analysis of such mass spectra ensemble allows the identification of OA components, either linked to primary sources or atmospheric processing (Zhang et al., 2011).

The refractory BC and BrC can be determined by means of Aethalometers, measuring the light absorption at different wavelengths. The analysis of multi-wavelength light absorption data, addressing the assessment of BrC, is still only incipient in Europe. The application of source apportionment models to these data allows to distinguish BC and BrC origin (road traffic vs biomass burning) (Zotter et al., 2017).

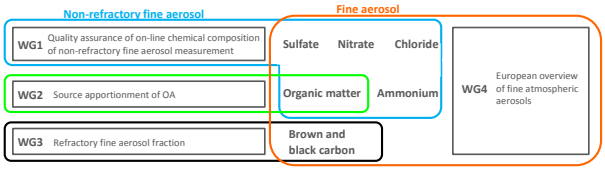

Figure 1. COST Action CA16109 structure.

Conclusions

The processing and interpretation of European data is enhanced within the COLOSSAL network. Activities leading to joint interpretation of refractory and non-refractory aerosol fractions are a step forward (Fig. 1). Outcomes will be relevant for air quality modellers and policy makers.

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