

Characterising organic carbon sources in the London area

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Introduction

Filter samples were collected from rural, urban background and roadside locations in the London region. A large set of OC measurements was explored in order to define different characteristics from each site. Analysis investigated relationships between the OC peaks in the thermograms and pollution sources, along with the effects of seasonality.

Method

A Sunset Laboratory Thermal-Optical Carbon Aerosol Analyzer was used for the OC analyses following the EUSAAR2 protocol (Cavalli et al, 2010). It uses thermal desorption in combination with optical transmission of laser light through the sample to speciate carbon collected on a quartz filter. Organic carbon is removed during a sequence of non-oxidizing temperature ramps from ambient to 650°C under a helium atmosphere, and then passes through a manganese dioxide oxidizing oven where it is converted to carbon dioxide. This is mixed with hydrogen and converted to methane over a heated nickel catalyst. The methane is subsequently measured using a flame ionization detector (FID).

By these analyses it was possible to determine the total OC for each sample and to define the different OC fractions desorbed during each of the four temperature steps in the helium atmosphere. There is an additional OC fraction of material that is pyrolyzed during the heating process.

To take into account the seasonality, daily PM₁₀ samples were collected during winter (6th January 2012 to 11th February 2012) and summer (21st July 2012 to 23rd August 2012).

Results

Fig. 1 shows the comparison between the average amounts of OC desorbed during each temperature step (labelled OC1 to OC4), and the pyrolyzed material (labelled POC), from the three sites in winter and summer. A clear spatial gradient can be seen with concentrations of OC1 to 4 increasing from rural to roadside indicating primary sources. Greater concentrations of OC4 were measured during the summer months, indicative of a more oxidised and less volatile organic carbon from photochemical processing.

Exhaust samples from the main air pollutant sources like diesel and petrol vehicles (Watson, 1994) were also analysed in order to characterize them by their relative OC peak abundances.

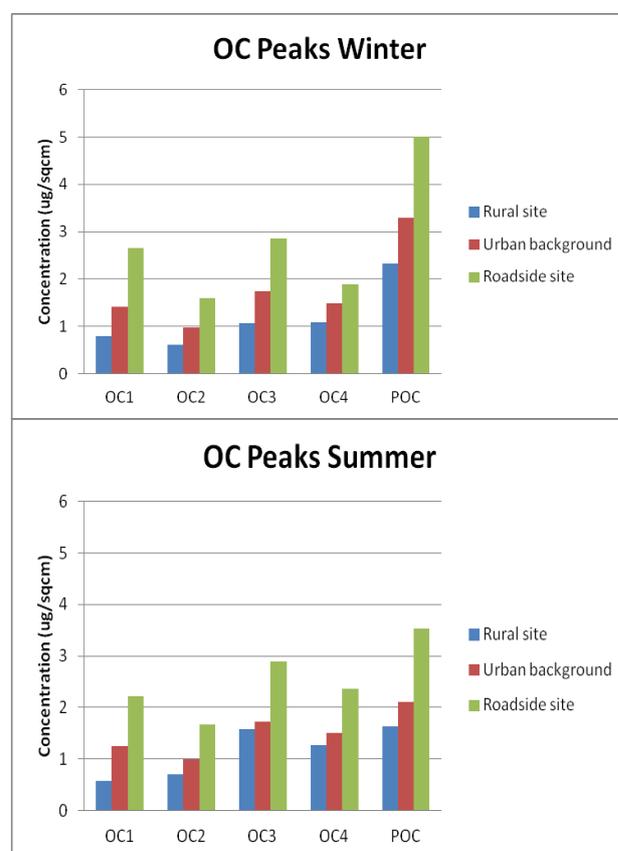


Figure 1. These two graph represent the average of the OC peaks in each site in winter and in summer.

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