Geophysical Research Abstracts
Vol. 12, EGU2010-8904-1, 2010
EGU General Assembly 2010

Investigation of sources of ambient submicron aerosol in the Barcelona metropolitan area using AMS mobile and stationary data

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The metropolitan area of Barcelona is exposed to relatively high particulate matter (PM) levels compared to other European regions (Pérez et al., 2008). A dry and warm Mediterranean climate, low dispersive conditions due to a unique topographical situation and high anthropogenic emissions contribute to the high PM levels.
The 2009 DAURE Aerosol Winter Campaign (23-February-2009 to 27-March-2009) focused on the characterization of the sources of fine and coarse aerosols in the Barcelona region, with particular attention to carbonaceous aerosols. An urban background and a rural background site were selected in order to characterize both urban plume and rural aerosols. Data presented here comes from the deployment of two Aerodyne high-resolution time-of-flight aerosol mass spectrometers (AMS) (DeCarlo et al., 2006); one at the urban background site, the other in the PSI mobile van. The fixed site AMS recorded continuously for the duration of the campaign and measured between 2 and 80 μg m-3 of non-refractory submicron PM, with organics making up the biggest fraction (42% on average). The mobile van was used for on-road measurements and investigations into the spatial variability of aerosol concentration and composition. 4 different driving routes including downtown Barcelona, the harbour area, the heavily industrialized valley of Llobregat and the region of Valles/Montserrat were driven 2-5 times each.
Positive Matrix Factorization (PMF) was applied to the organic fraction of submicron PM as measured by the two AMS in order to investigate components and sources of organic aerosol in the Barcelona region. Results indicate significant contributions from primary traffic sources and secondary sources, with less contribution from biomass burning. Other possible contributors include cooking emissions.
Mobile van data shows that secondary organic aerosol makes up a significant fraction of PM1 mass in the whole Barcelona region. Spatially, different sources can be dominant with local concentration peaks in different areas attributed to primary emissions from traffic, biomass and waste burning, industry or ships.

Pérez, N., et al, (2008). Atmos. Environ., 42: 1677-1691.
DeCarlo, P., et al. (2006). Anal. Chem., 78, 8281-8289