Geophysical Research Abstracts
Vol. 13, EGU2011-5701, 2011
EGU General Assembly 2011

Particulate organic nitrate concentrations in Europe as observed by aerosol mass spectrometry

Astrid Kiendler-Scharr (1), Eiko Nemitz (2), Andre Prevot (8), and the EUCAARI-AMS Team

(1) FZ-Jülich, IEK-8: Troposphäre, Jülich, Germany (a.kiendler-scharr@fz-juelich.de), (2) Centre for Ecology and Hydrology (CEH), U.K; , (8) Paul Scherrer Institute (PSI), Switzerland;

Three intensive field campaigns, each of one-month duration, were performed within the EU-project EUCAARI (European Integrated Project on Aerosol Cloud Climate Air Quality Interactions; Kulmala et al., 2009) and EMEP (European Monitoring and Evaluation Programme) in spring 2008, autumn 2008, and spring 2009. An unprecedented number of Aerodyne aerosol mass spectrometers (AMS, up to 14 instruments at a time) were set up in various countries at rural and remote sites across Europe. AMS measurements were conducted, analysed and quality controlled carefully using a unified protocol, providing the largest spatial database of aerosol chemical composition measured with a unified online technique to date, and unique snapshots of the European non-refractory submicron aerosol climatology (Nemitz et al., in preparation). The measurements show that in NW Europe (e.g. Ireland, UK, The Netherlands, Germany, Switzerland) the regional submicron aerosol tends to be neutralised and here total nitrates make a major contribution to the aerosol mass. By contrast, periods with low nitrate and acidic aerosol were observed at sites in S and E Europe (e.g. Greece, Finland), presumably due to a combination of larger SO2 point sources in Easter Europe, smaller local NH3 sources and, in the case of Greece, higher temperatures.
Attempts were also made to extract the particulate nitrate mass fraction that could be ascribed to organic nitrates, based on unit-mass and high resolution AMS data. The organic nitrate fraction was extracted based on the abundance of NO+ and NO2+ in the data with low ratios of NO2+/NO+ indicative of organic nitrates (Fry et al., 2009). Campaign average concentrations of organic nitrates ranged from below detection limit at remote and elevated sites to 1.6 μg m-3 in San Pietro Capo Fume in May 2008. The fraction of nitrate that was assigned to be non-NH4NO3 ranged from 20% to 60% with typical values around 30%. Similar to the NH4NO3 the organic nitrate was observed to show a diurnal behaviour with maximum concentrations during the night time. One source of organic nitrates is the oxidation of biogenic volatile organic compounds by the nitrate radical, which has a maximum concentration during the night time. Observations will be discussed with respect to possible sources of organic nitrates and their implications for air quality.

Acknowledgement: We gratefully acknowledge support by the European Commission (IP-EUCAARI, contract number 036833-2).

Kulmala et al., Introduction: European Integrated Project on Aerosol Cloud Climate and Air Quality interactions (EUCAARI) – integrating aerosol research from nano to global scales, ACP 9, 3443-3444, 2009
Nemitz et al., A snapshot European climatology of submicron aerosol chemical composition derived from an Aerosol Mass Spectrometer network, in preparation 2011
Fry et al., Organic nitrate and secondary organic aerosol yield from NO3 oxidation of beta-pinene evaluated using a gas-kinetics/aerosol partitioning model, ACP 9, 1431-1449, 2009