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Real time chemical characterization of local and regional nitrate aerosols

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Abstract. Nitrate aerosols make a very major contribution to $PM_{2.5}$ and PM_{10} in western Europe, but their sources and pathways have not been fully elucidated. An Aerosol Time-of-Flight Mass Spectrometer (ATOFMS) and a Compact Time of Flight Aerosol Mass Spectrometer (C-ToF-AMS) were deployed in an urban background location in London, UK, collecting data as part of the REPARTEE-I experiment. During REPARTEE-I, daily PM_{10} concentrations ranged up to 43.6 μg m^{-3}, with hourly nitrate concentrations (measured by AMS) of up to 5.3 μg m^{-3}. The application of the ART-2a neural network algorithm to the ATOFMS data characterised the nitrate particles as occurring in two distinct clusters (i.e. particle types). The first (33.6% of particles by number) appeared to be locally produced in urban locations during nighttime, whilst the second (22.8% of particles by number) was regionally transported from continental Europe. Nitrate in locally produced aerosol was present mainly in particles smaller than 300 nm, whilst the regional nitrate presented a coarser mode, peaking at 600 nm. In both aerosol types, nitrate was found to be internally mixed with sulphate, ammonium, elemental and organic carbon. Nitrate in regional aerosol appeared to be more volatile than that locally formed. During daytime, a core of the regionally transported nitrate aerosol particle type composed of organic carbon and sulphate was detected.

Final Revised Paper (PDF, 628 KB) | Discussion Paper (ACPD)

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