

Abstract

Atmospheric aerosols were studied by three different means. Laboratory experiments determined the relative ionization efficiency of water (RIE_{H_2O}) in an Aerodyne Aerosol Mass Spectrometers (AMS), simulation chamber experiments gave insight to the reaction products of biogenic volatile organic compounds (BVOC) oxidation products, and the findings were applied to two field campaign measurements at Cabauw, NL, in May 2008 and February 2009. Knowing the liquid water content of aerosol particles is vital for the assessment of their climate forcing potential. A value of 2 for RIE_{H_2O} was determined by studying oxalate salts with different amounts of crystal water. BVOCs contribute much more to the global budget of VOCs than anthropogenic ones but oxidation products in terms of secondary organic aerosol often correlate to anthropogenic tracers such as NO_x from fossil fuel burning. In atmospheric simulation chamber experiments, organic nitrates from BVOC- NO_3 oxidation showed higher vapor pressures than pure organic compounds produced in the same reactions. Organic nitrates comprised up to approx. 41 % of the particulate phase. A specific fragmentation ratio of nitrate (NO_2^+/NO^+) of 0.1 was found by high resolution AMS analysis differing strongly from the value of 0.4 known for the most abundant ambient NO_3 specie (NH_4NO_3). Ambient average particulate mass loadings were $9.72 \mu\text{g}/\text{m}^3$ dominated by organics (40 %) in 2008 and $5.62 \mu\text{g}/\text{m}^3$ dominated by nitrate (42 %) in 2009. Data comparison to collocated instruments showed good agreement. Positive Matrix Factorization analysis of the particulate organic fraction distinguished semi and low volatile oxygenated organic aerosol (OOA) as well as hydrocarbon like organic aerosol (HOA) in both campaigns. An additional highly oxygenated OA with a mass spectrum very similar to fulvic acid was found in 2008. The average contribution of organic nitrate to the particulate nitrate mass was 34.9 % in 2008 and 5.2 % in 2009.