Geophysical Research Abstracts
Vol. 14, EGU2012-6829, 2012
EGU General Assembly 2012

SOA Formation from Glyoxal in the Aerosol Aqueous Phase: A case study from Mexico City using an explicit laboratory-based model

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Glyoxal is an important contributor to secondary organic aerosol (SOA) formation via aerosol aqueous phase processing. This work takes a glyoxal-SOA model parameterization based on laboratory data and applies the box model to ambient measurements. For the Mexico City Metropolitan Area (MCMA) case study on April 9, 2003 the aerosol uptake and processing of glyoxal in aerosol water is investigated, and found able to rationalize the previously observed gas phase glyoxal imbalance (Volkamer et al., 2007) for the first time based on laboratory data. Our aerosol size distribution resolving model is constrained with time resolved distributions of aerosol chemical composition, and supports a surface limited uptake mechanism of glyoxal in Mexico City. We compare the AMS-measured OOA to SOA predictions using our glyoxal model combined with background aerosol, traditional VOC precursor (e.g., aromatics) SOA, and three parameterizations for SOA formation from S/IVOC, i.e. based on (1) Robinson et al., 2007, (2) Grieshop et al., 2009, and (3) GECKO-A (Lee-Taylor et al., 2011), which account for the bulk of SOA mass, but give very different results for the O/C ratio of predicted SOA. This presents to our knowledge the first comparison of a molecular perspective of S/IVOC ageing with empirical parameterizations. We compare the mass weighted O/C ratio from these different SOA sources to AMS-measured O/C ratios, in an attempt to use the rapidly increasing O/C to test for closure, and advance our understanding of aerosol ageing in Mexico City.