Geophysical Research Abstracts
Vol. 16, EGU2014-10518, 2014
EGU General Assembly 2014

Secondary organic aerosol formation from isoprene photo-oxidation during cloud condensation-evaporation cycles (CUMULUS project)

Lola Brégonzio-Rozier (1), Frank Siekmann (2), Chiara Giorio (3,4), Brice Temime-Roussel (2), Edouard Pangui (1), Sébastien Morales (1), Aline Gratien (1), Sylvain Ravier (1), Anne Monod (2), and Jean-Francois Doussin (1)

(1) University of paris East at Créteil, LISA, Chemistry, Créteil, France (jean-francois.doussin@lisa.u-pec.fr, 33.1.45.17.15.64), (2) Aix-Marseille Université, CNRS, LCE FRE 3416, 13331, Marseille, France, (3) Department of Chemistry, University of Cambridge, Cambridge CB2 1EW, U.K., (4) Dipartimento di Scienze Chimiche, Università degli Studi di Padova, Padova, 35131, Italy

It is acknowledged that atmospheric photo-oxidation of Volatile Organic Compounds (VOC) leads to the formation of less volatile oxidized species. These compounds can undergo gas-to-particle conversion, leading to the formation of Secondary Organic Aerosols (SOA) in the atmosphere. Nevertheless, some of these oxidized species are water soluble and could also partition into cloud droplets. Higher molecular weight and less volatile compounds could be produced in the aqueous phase and remain in the particle phase after water evaporation (Ervens et al., 2011).

The aim of the present work is to study SOA formation in the presence of cloud droplets during isoprene photo-oxidation. To this end, an original multiphase approach in a simulation chamber was set up in order to investigate the chemistry occurring in the gaseous, particulate and aqueous phases, and the exchange between these phases.
Experiments were performed, within the CUMULUS project (CloUd MULtiphase chemistry of organic compoUndS in the troposphere), in the CESAM chamber (Wang et al., 2011). This chamber was designed to investigate multiphase processes under realistic actinic flux, and accurate control of both temperature and relative humidity. A specific protocol was set up to produce cloud events in the simulation chamber exhibiting a significant lifetime in the presence of light (10-12 minutes). By using this protocol, many clouds could be generated in a single experiment.
In each experiment, around 800 ppb of isoprene was injected in the chamber together with HONO under dry conditions before irradiation. A Fourier Transform Infrared Spectrometer (FTIR), a Proton Transfer Reaction Mass Spectrometer (PTR-TOF-MS) and NO_x and O_3 analyzers were used to analyze gas-phase composition. Dried SOA size distributions and total concentrations were measured by a Scanning Mobility Particle Sizer (SMPS). An Aerodyne High Resolution Time-Of-Flight Aerosol Mass Spectrometer (HR-TOF-AMS) was also used to investigate aerosol composition. Cloud droplets size distributions were measured by a white light Optical Particle Counter (OPC).
In all experiments, the dissolution of gaseous oxidation products into aqueous phase and SOA production have been observed during isoprene photo-oxidation in the presence of a cloud event. The overall results in additional SOA mass production and the dynamic of gaseous oxidation products and SOA mass concentrations will be presented.

Ervens, B. et al. (2011). Atmospheric Chemistry and Physics 11(21): 11069-11102.
Wang, J. et al. (2011). Atmospheric Measurement Techniques 4(11): 2465-2494.