Microscopic Measurements of Aerosols Collected During CARES

R. C. Moffet¹, T. C. Rödel¹, S. Kelly¹, R. Zaveri², S. Nizkorodov³, A. Laskin² and M. K. Gilles¹
¹Lawrence Berkeley National Laboratory, ²Pacific Northwest National Laboratory, ³U.C. Irvine

Abstract
During the carbonaceous aerosols and radiative effects study (CARES), chemical composition and mixing state was determined with spectroscopic techniques. Using scanning electron microscopy, a variety of particles were observed including fresh/aged sea salt and primary biological particles (brochosomes). X-ray spectromicroscopy measured an increase in carboxylic acids and a decrease in carbon-carbon double bonds due to oxidative aging. Moreover, the number of homogeneous organic particles increased over a period of two days at the end of the study. Lastly, a statistical analysis of particles indicates that soot inclusions had much larger coating in Sacramento compared to Los Angeles.

Experimental

Results

STXM/NEXAFS Spectromicroscopy

June 28 T0 7:29
June 28 T1 17:17
June 28 T0 12:29
June 28 T1 17:17
G1 June 15 Fresh
G1 June 15 Aged

Aerosol component maps (above) for June 28. Processing of seassalt measured on the G1 shows a disappearance of distinct NaCl crystals.

The mixing state (left) of the particles changed slowly from June 27 to June 28, becoming more organic dominant with time.

The amount of carboxylic acids increases and carbon
-carbon double bonds decreases with age (right and below).

Conclusions
Aerosol particles sampled in Sacramento during CARES had an abundance of organic species, sea salt and sulfates. From June 27 to 28, an increase in homogeneous organic particles was observed - likely due to secondary organic aerosol formation. As particles aged, a decrease in carbon-carbon double bonds and an increase in carboxylic acids was measured. The majority of soot particles observed in Sacramento were aged, with coatings that were much larger than the soot inclusions.

Acknowledgements
We would like to acknowledge generous support from the Department of Energy's Atmospheric Systems Research program. Also, A. Bateman, T. Nguyen, D. Bone, and N. Levac kindly collected samples at Caltech during CALNEX.
T0, T1 samples: June 28 Episode
WRF Tracer Forecast 16 PST

G1 samples: June 15 Episode

June 15 AM Flight
T0, T1 samples: June 28 Episode

June 28 T0 12:29

Age

June 28 T1 17:17

Primary Biological  Sulfate  Organic
Sea Salt  Soot

Fraction of Particles

- Organic Only
- Soot + Organic
- Soot + Organic + Inorganic
- Inorganic + Organic
G1 samples: June 15 Episode

**fresh**

Samples are dominated by sea salt and amm. sulfate, low organics

**aged**

Processed sea salt, higher organics
High resolution MS molecular characterization of CARES samples

A. Laskin, J. Laskin, P. Roach, B. Heath