High-Resolution Modeling of Aerosol Composition and Optical Properties Associated with Anthropogenic and Biogenic Precursor Emissions during CARES

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Objectives

Organic matter (OM) comprises a large fraction of the total aerosol burden in many places of the world; however, large uncertainties remain in the prediction of secondary organic aerosol (SOA) formation and transformation that likely affects aerosol radiative forcing. Our current objectives are to:

- Use the WRF-Chem model and measurements from the Carbonaceous and Radiative Effect Study (CARES) to test and evaluate predictions of aerosol mass, composition, and size over regional spatial scales produced by state-of-the-science aerosol process modules
- Quantify performance of simulated OM and SOA based on the volatility basis set (VBS) approach
- Produce a "control" simulation for comparing against future improved treatments of SOA
- Evaluate anthropogenic and biogenic emissions that affect SOA formation and transformation

Model Description

- SOA: 2-species VBS approach for anthropogenic SOA, coupled MOSAIC aerosol model with 4 size bins and SAPRC trace-gas chemistry (Shrivastava et al., 2011)
- Boundary Conditions: Time-varying BC for chemistry and aerosols obtained from global MOZART model
- Emissions: On-line biogenic emissions from MEGAN model, anthropogenic emissions from CARB ARCTAS 2008
- Simulation Period: All of June 2010, with 3-days of spin-up
- Evaluation Methodology: Employ the Aerosol Modeling Testbed (Fast et al., 2011) with the CARES "testbed case"

Results at Surface Sites

- Simulated OM usually too high
- Simulated BC too high at T0, are primary particulates too high?
- Biogenic species better at remote site
- Simulated NOx and CO too high also suggests emissions may be too high

Results Aloft

- Implemented multi-generational chemistry of biogenic SOA precursors and examine anthropogenic-biogenic interactions
- Investigate sensitivity to semi-volatile SOA precursors
- Compare with SOA from CAMS's Modal Aerosol Model

Future Steps

- Implement multi-generational chemistry of biogenic SOA precursors and examine anthropogenic-biogenic interactions
- Investigate sensitivity to semi-volatile SOA precursors
- Compare with SOA from CAMS's Modal Aerosol Model

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