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

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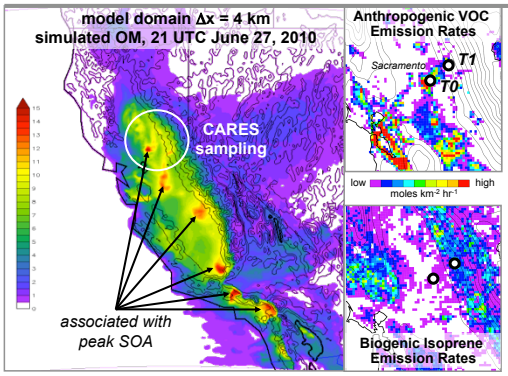
Objectives

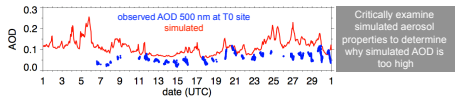
Organic matter (OM) comprises a large fraction of the total aerosol burden in many places of the world; however, large uncertainties remain in the prediction of secondary organic aerosol (SOA) formation and transformation that likely affects aerosol radiative forcing. Our current objectives are to:

- *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*

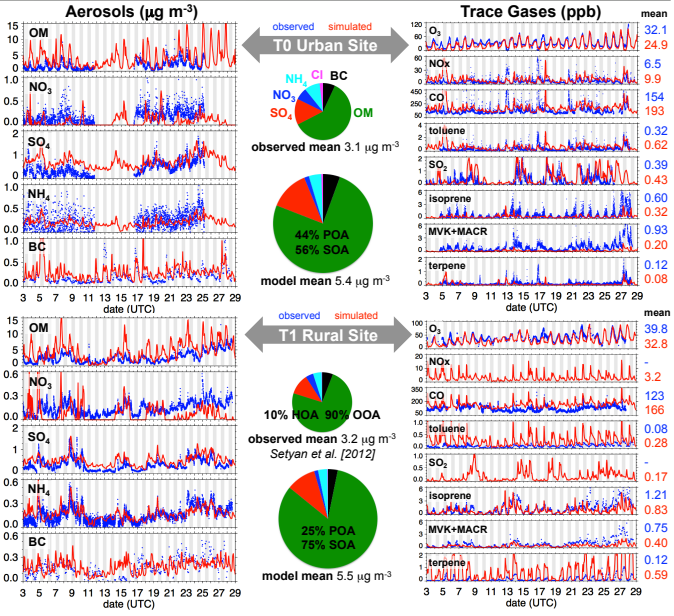
Model Description



- ***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 inventory where trace-gas emissions are reduced by 1/3*
- ***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"*

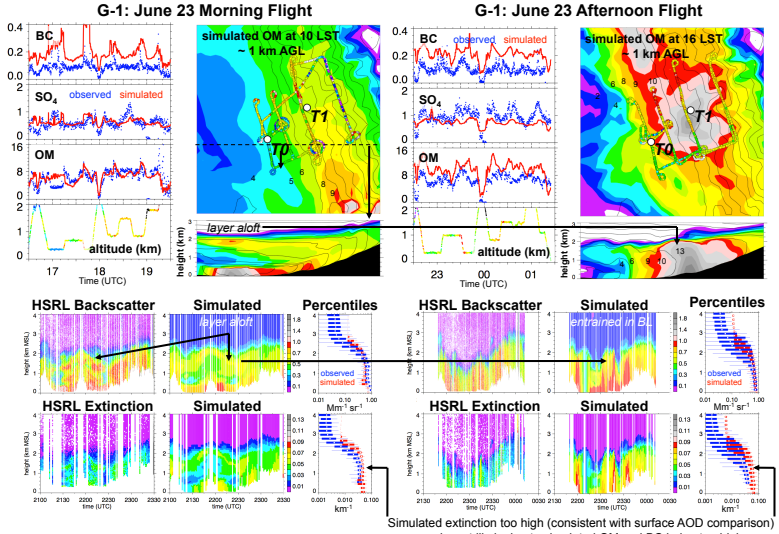


Results at Surface Sites



- *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



Simulated extinction too high (consistent with surface AOD comparison) and most likely due to simulated OM and BC being too high

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 CAM5's Modal Aerosol Model*

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