CARES: Semi-volatile vs. Non-volatile SOA

Objective: Investigate the semi-volatile versus non-volatile SOA treatments using the WRF-Chem model against measurements during the CARES 2010 field

Climate Relevant SOA Property(s) Investigated: Volatility, semi-solid nature of SOA

Lead personnel: Manish Shrivastava, Alla Zelenyuk, Dan Imre, Jerome Fast, Richard Easter, Rahul Zaveri, Ying Liu, John Shilling, Qi Zhang, Ari

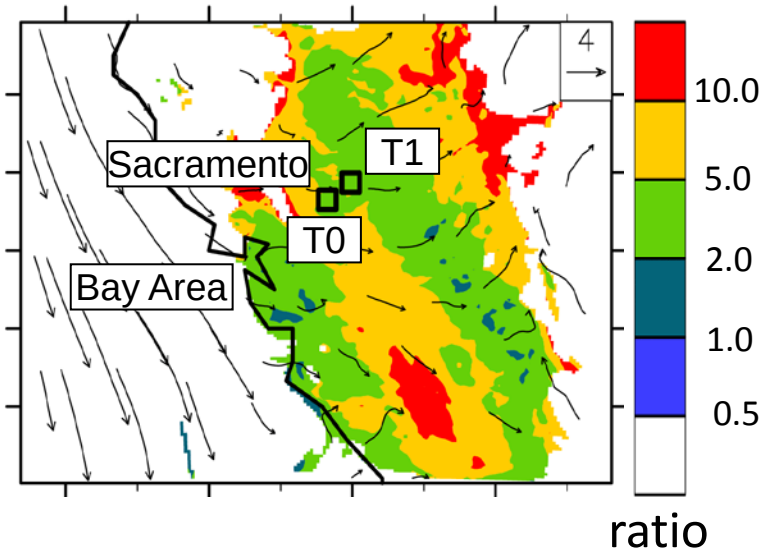
Summary of progress:

- Non-volatile semi-solid SOA treatment in WRF-Chem model agrees with measurements during CARES 2010 field campaign
- Previous equilibriated semi-volatile SOA treatment shows large spatial and temporal differences with measurements
- The response of SOA to diurnal temperature variations within the boundary layer provide key insights about fundamental SOA properties

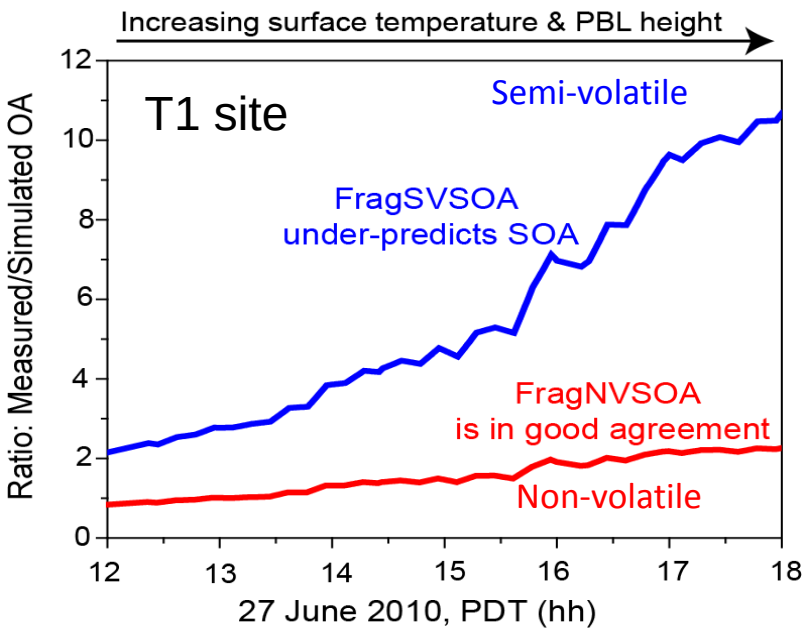
Challenges or needed resources/collaborators: Similar SOA measurements and modeling studies about volatility in other locations around the world; Effects of RH and T

Semi-volatile vs. Non-volatile SOA

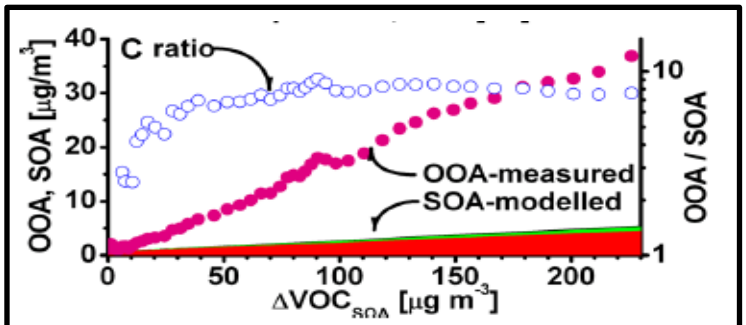
Ratio: Non-volatile/Semi-volatile



Ratio: Measured/Simulated OA



- WRF-Chem simulated ratio of non-volatile to semi-volatile SOA varies by factor of 2 to 10
- Model largely under-predicts SOA in the semi-volatile treatment
- Ratio of measured to semi-volatile SOA shows strong diurnal variations with surface temperature and PBL height
- The non-volatile SOA at surface is much closer to measurements
- Fundamental SOA processes and properties need to be represented accurately in models



Volkamer et al. GRL 2006