



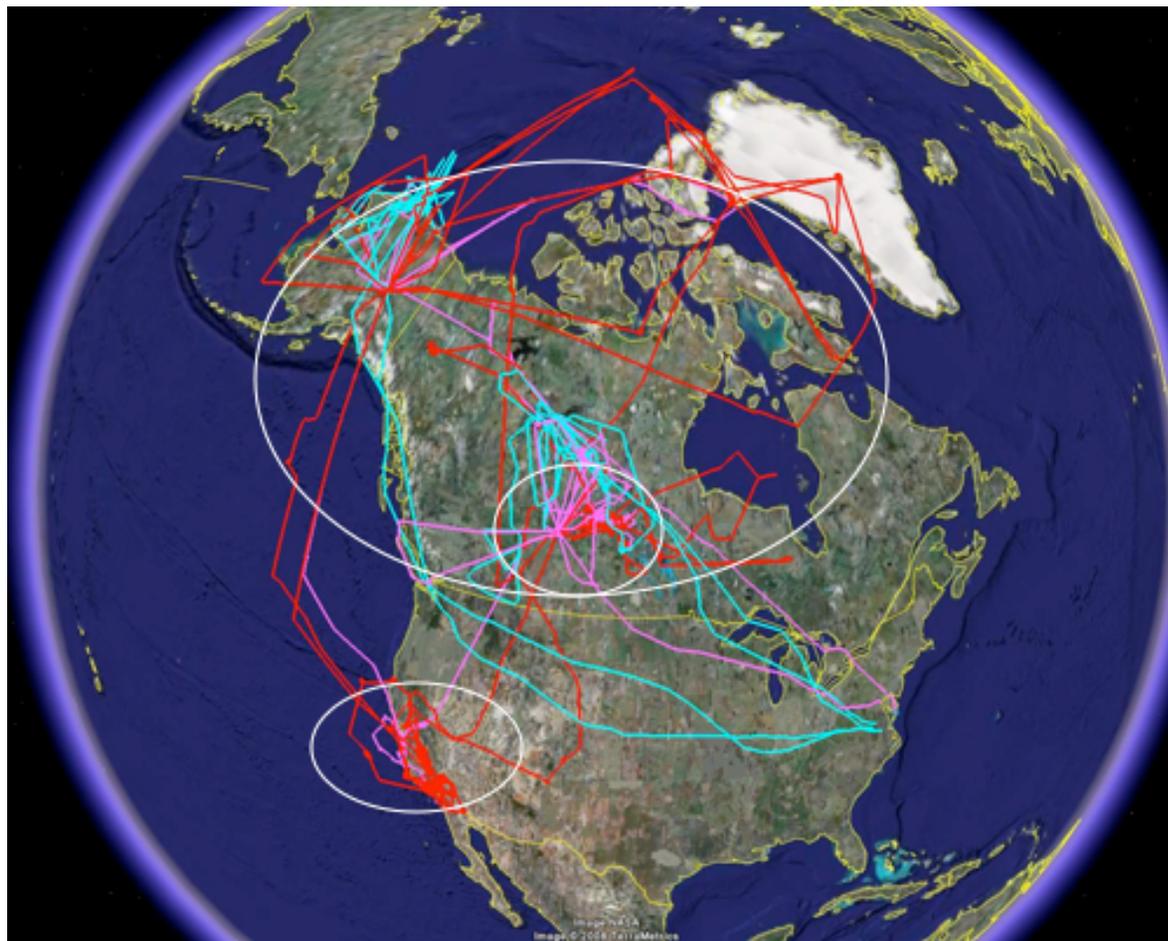
ARCTAS/CARB 2008



H. B. Singh, NASA Ames Research Center

A collaboration between NASA and the California Air Resources Board focused on CA Air Quality and Climate

DC-8: 4 flights (33 hrs); P-3B: 1 flight (8 hrs)- June 2008, Palmdale, CA



NASA DC-8

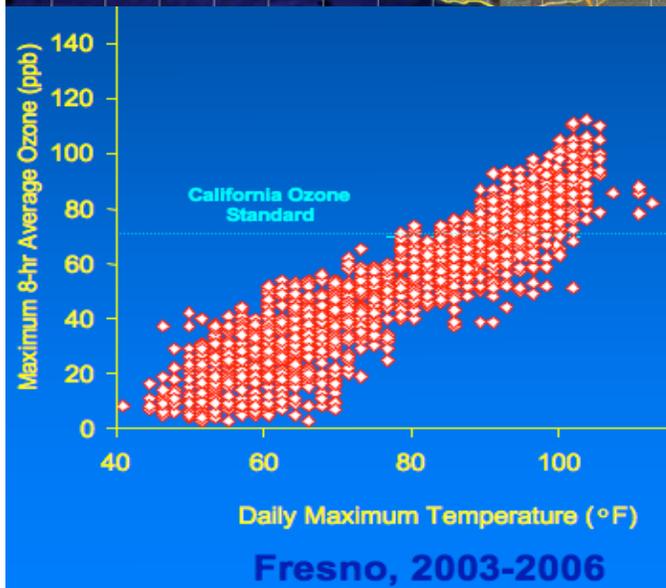
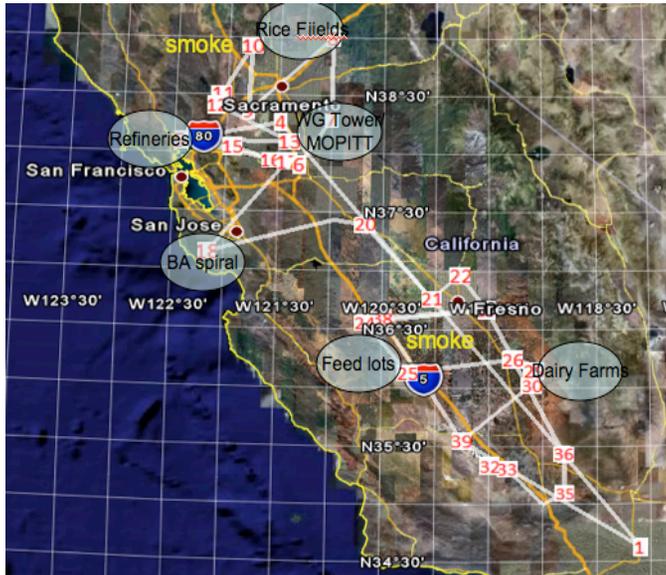


NASA P-3B





ARCTAS/CARB 2008: Goals & Objectives

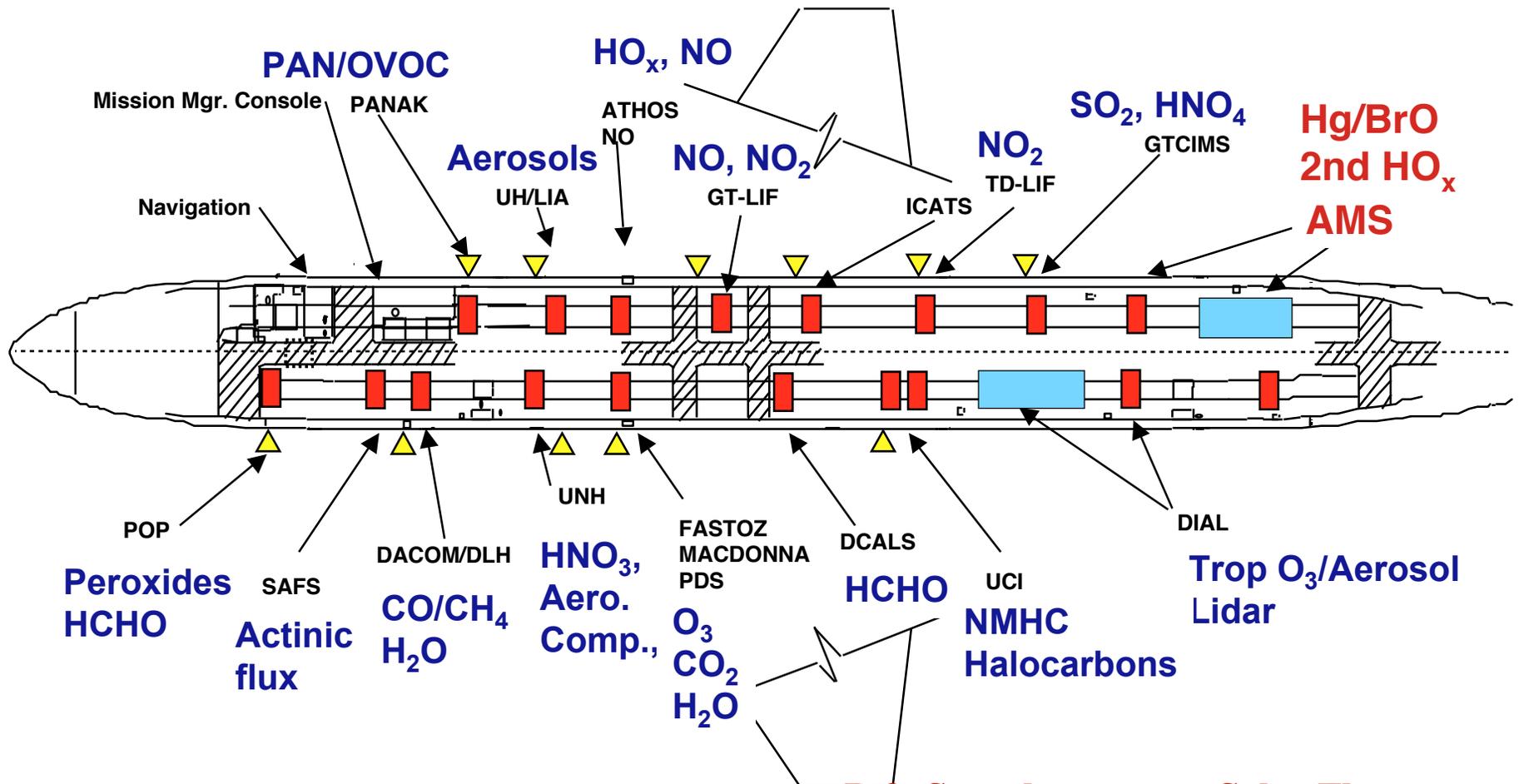


GOAL: Leverage the capability assembled for the ARCTAS field campaign to address CA AQ objectives:

- **Improve accuracy of emissions inventories for GHG & aerosols**
- **Characterize composition/chemistry over South Coast Air Basin and Central Valley**
- **Characterize offshore emissions of sulfur and other pollutants from shipping and natural sources**
- **Characterize upwind boundary conditions necessary to model local ozone and aerosols**
- **Relate airborne & satellite observations**



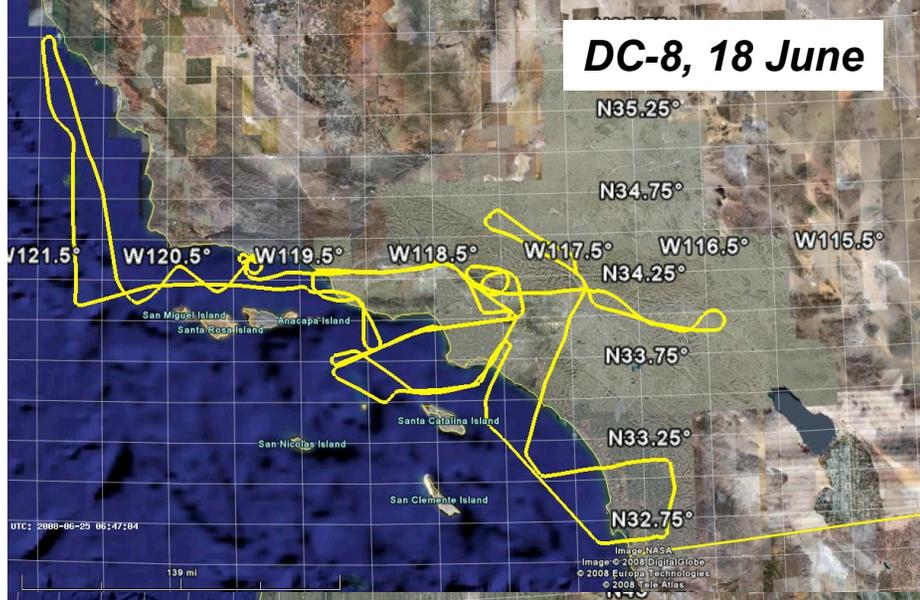
ARCTAS Payload for NASA DC-8 & P-3



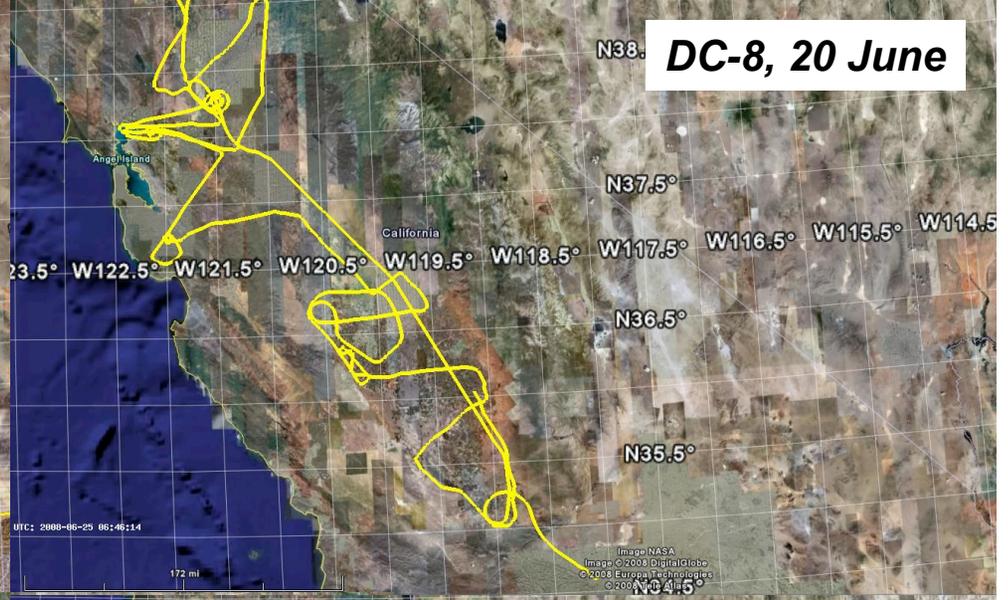
P-3: Sun photometer, Solar Flux Radiometer, Cloud Absorption Radiometer, Scanning Polarimeter, Aerosol, CO, O₃

▲ PROBE

LA Basin and Offshore Ship Emissions



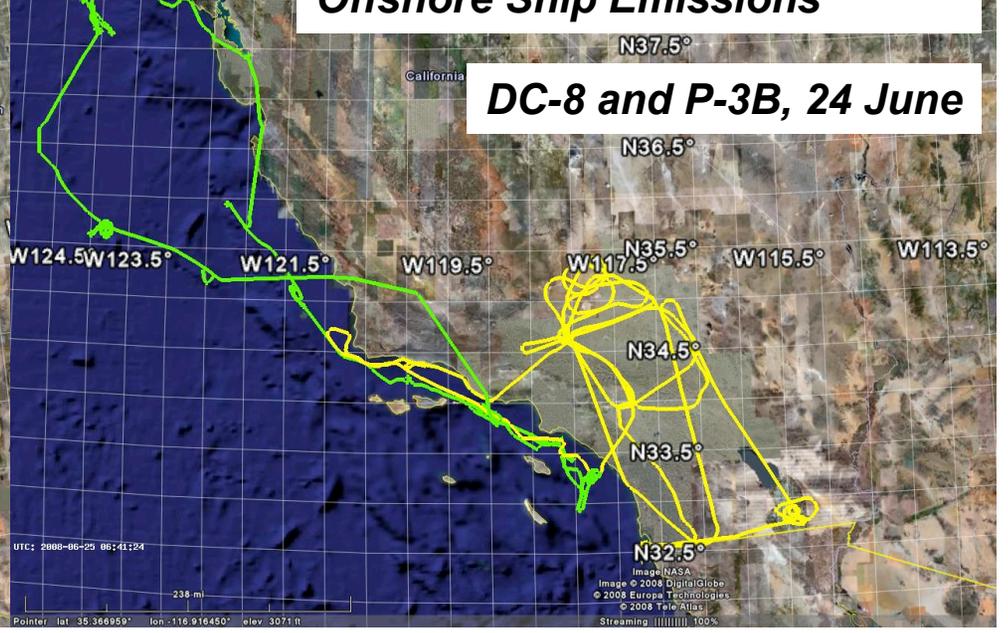
California Central Valley Emissions



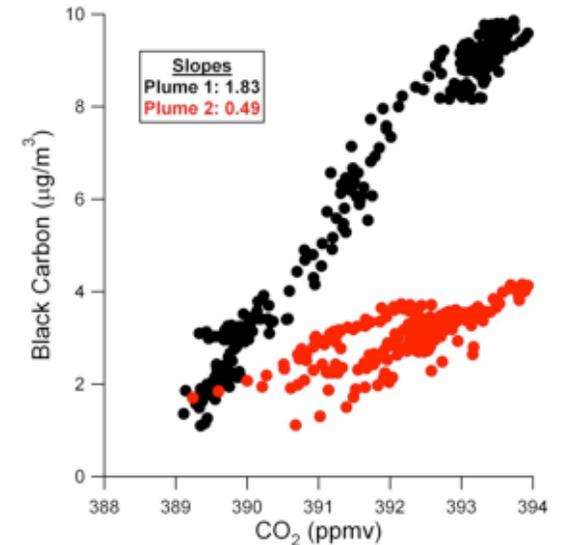
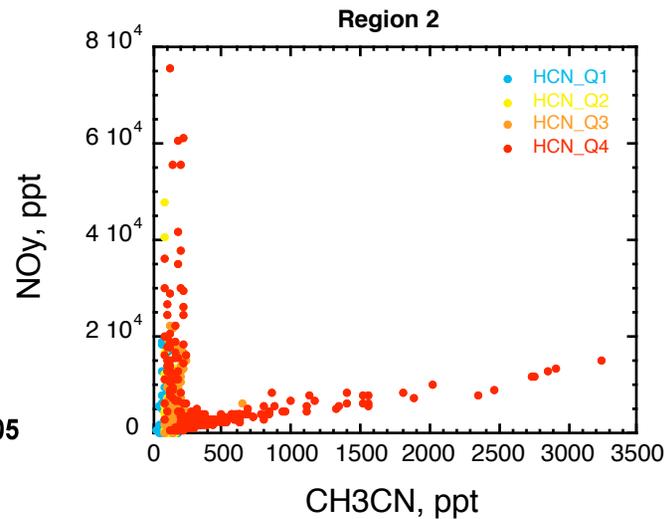
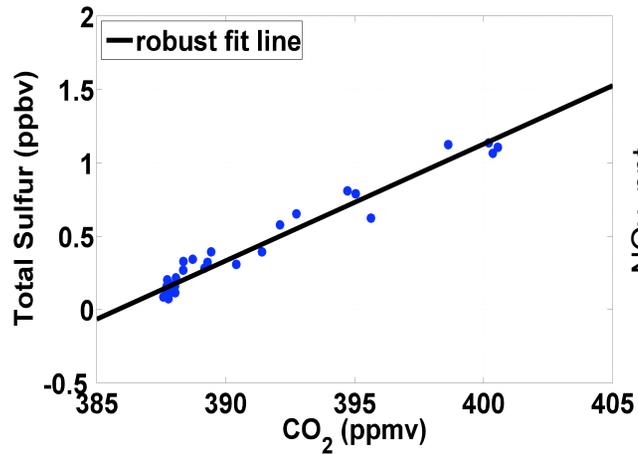
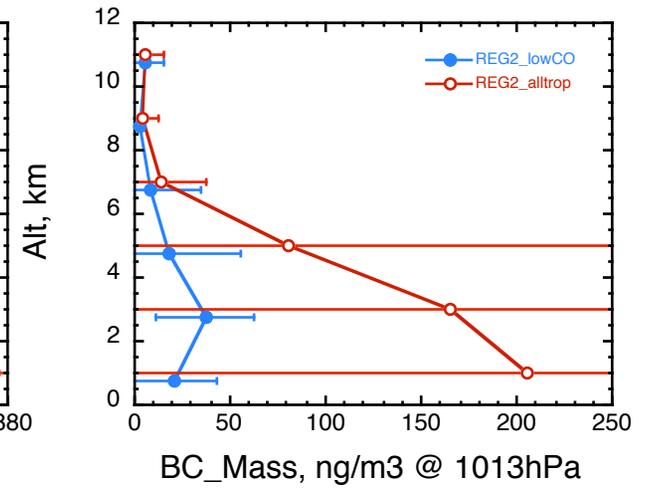
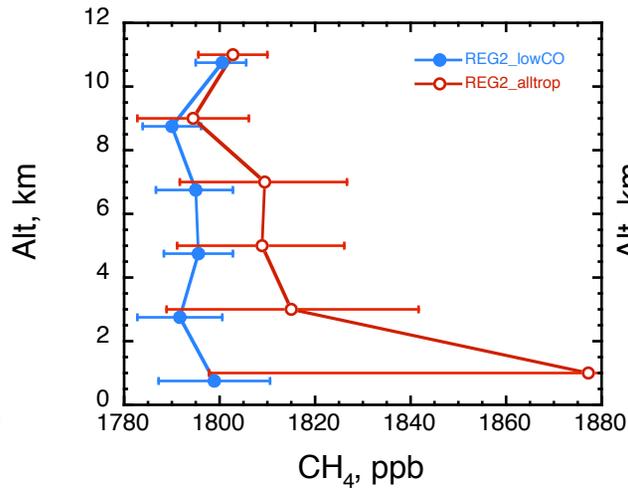
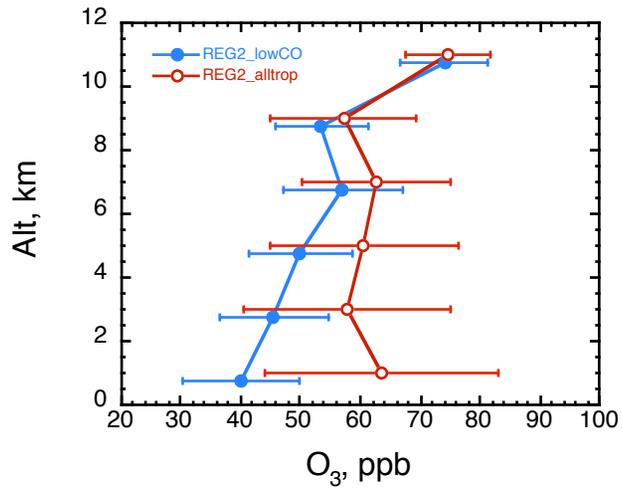
California Upwind Boundary Conditions



LA Basin Diurnal Evolution and Offshore Ship Emissions



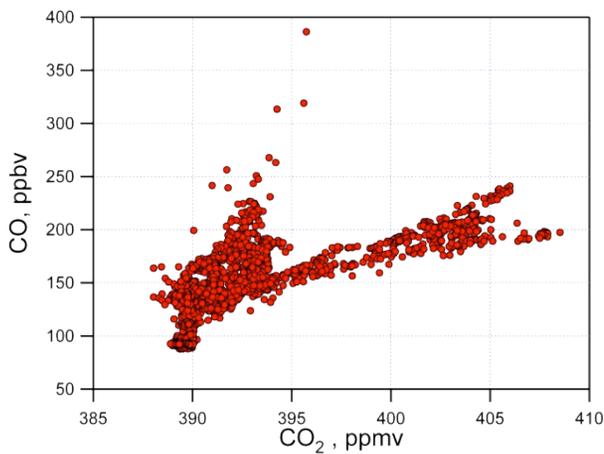
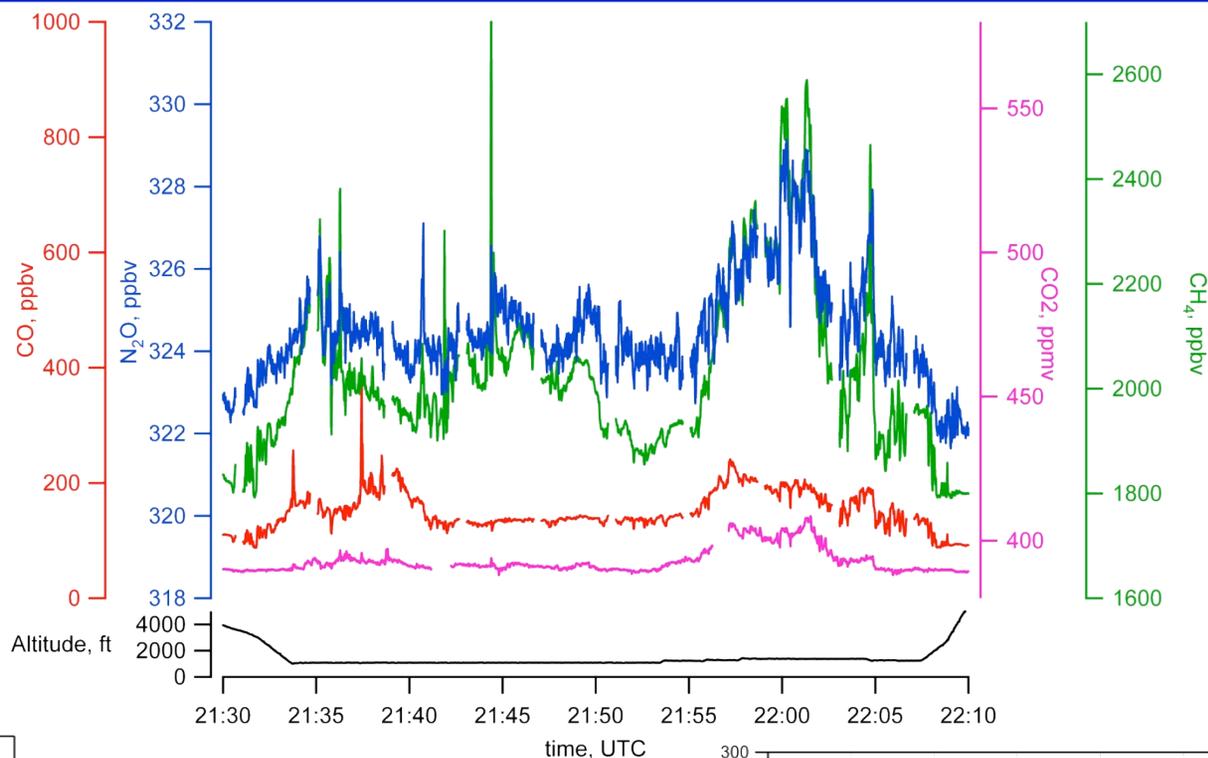
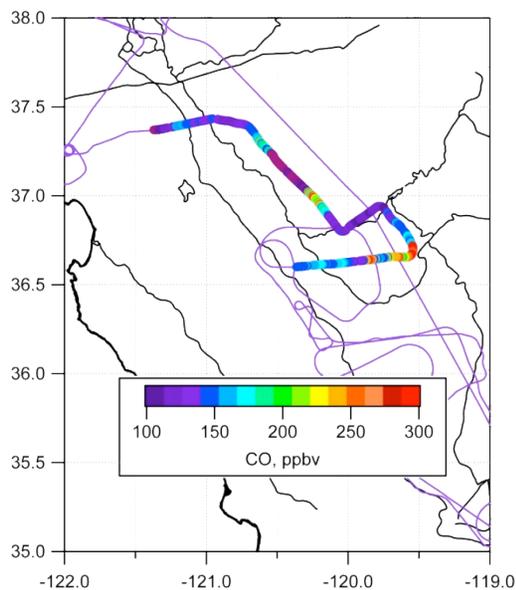
Pollutant distributions & relationships over CA





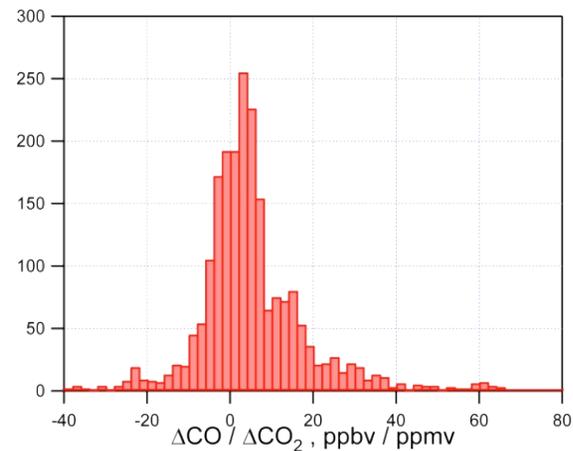
ARCTAS Flight #13 / CARB Flight #2

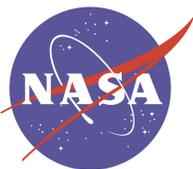
low-level flight over agriculture, biomass burning, urban, other



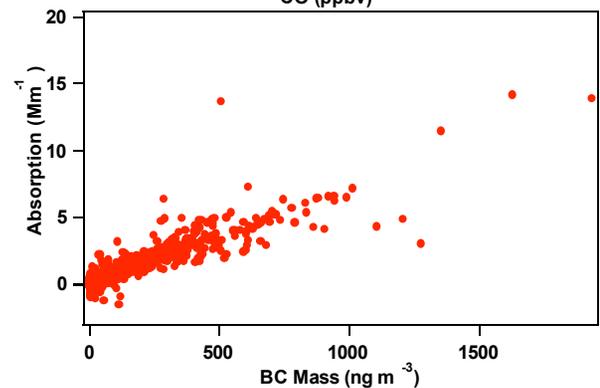
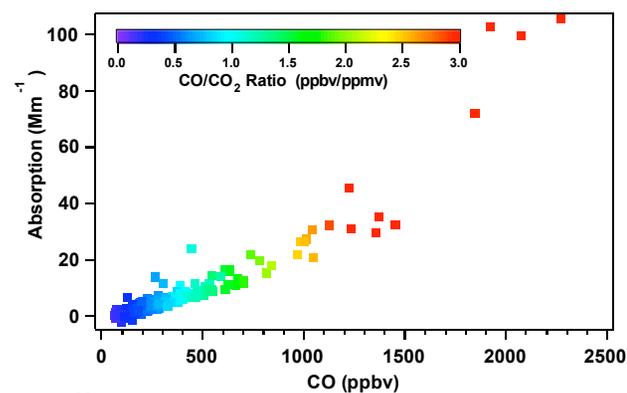
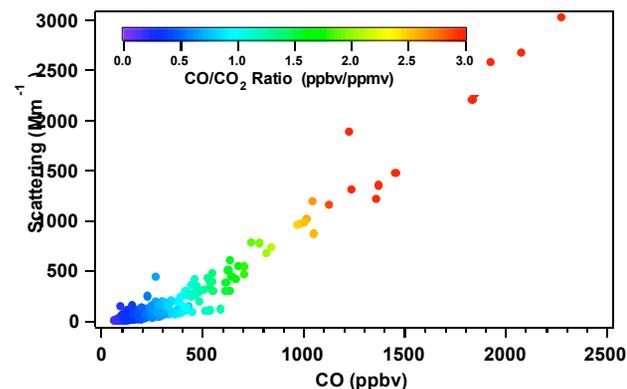
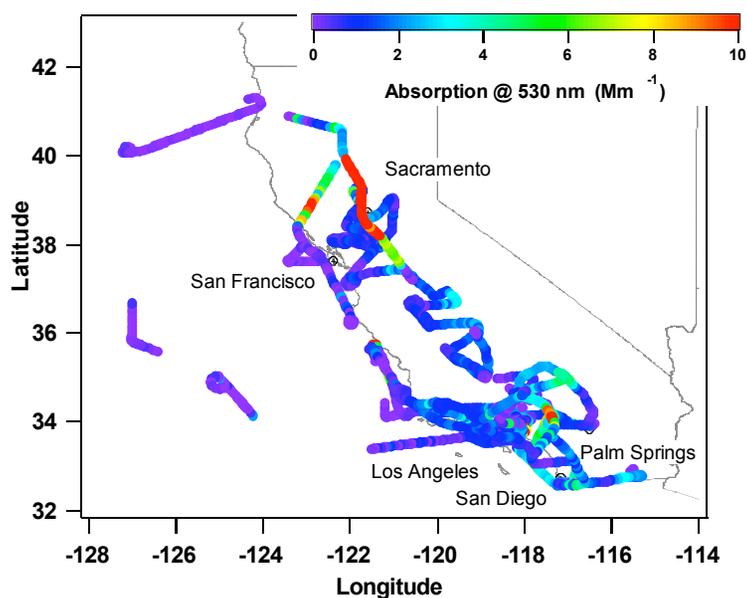
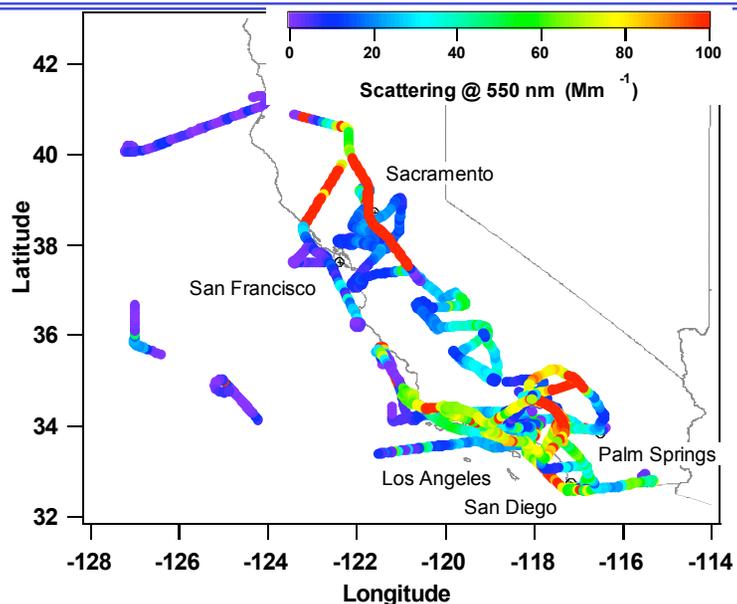
$\Delta\text{CO} / \Delta\text{CO}_2$ shows several modes in this 40 minute segment

- 60×10^{-3} – biomass burning
- 5×10^{-3} – automotive
- $10\text{-}30 \times 10^{-3}$ – uncertain
- negative slope – drawdown ?



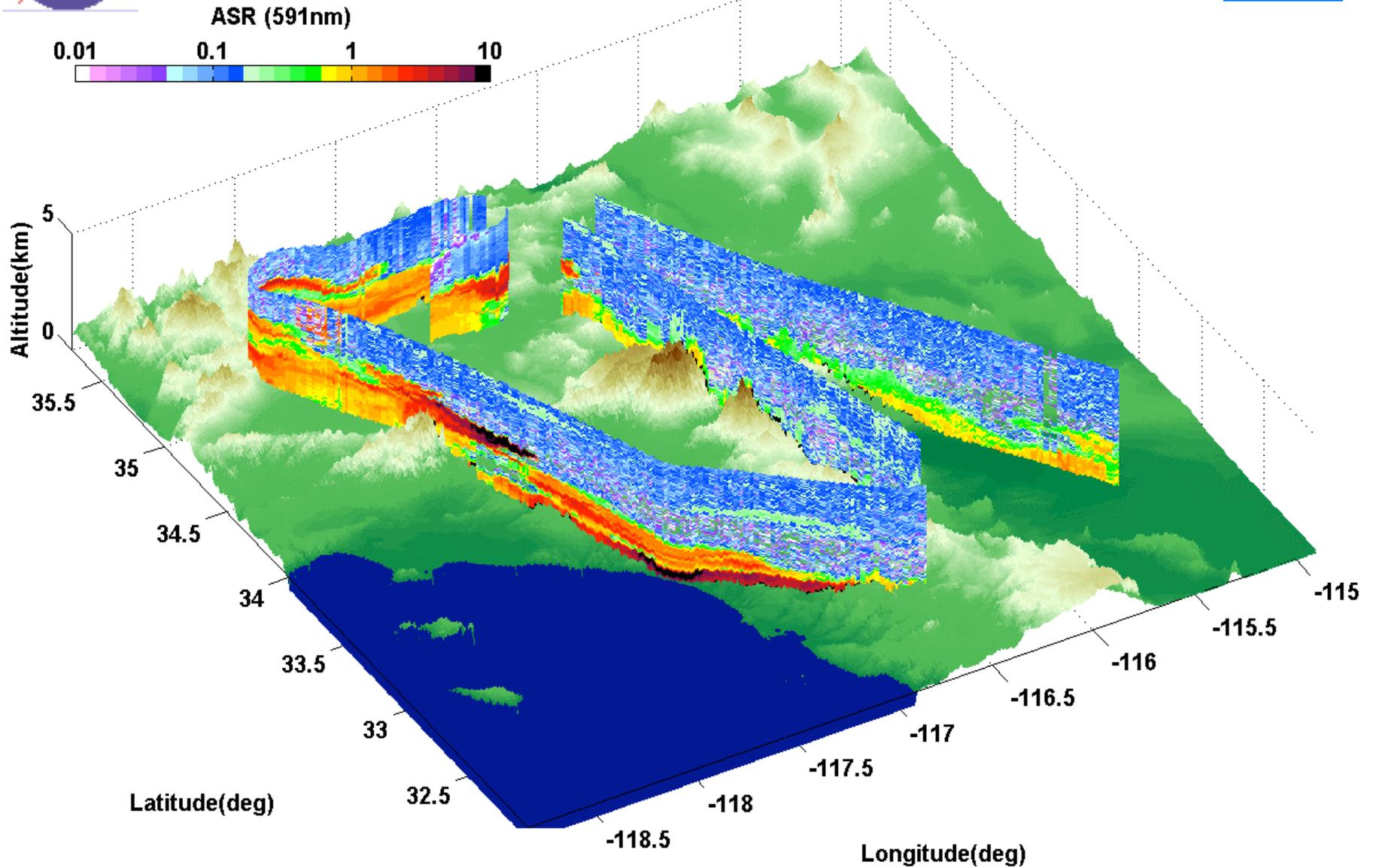


Anthropogenic Impact on Aerosol Direct Effect (ARCTAS/CARB)

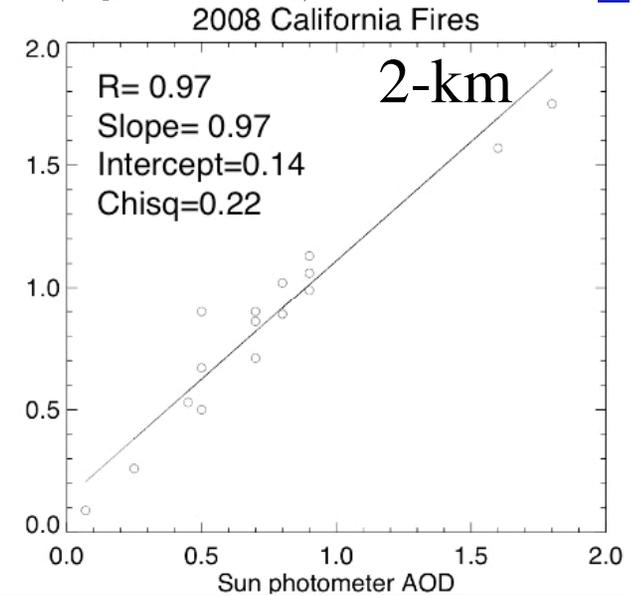
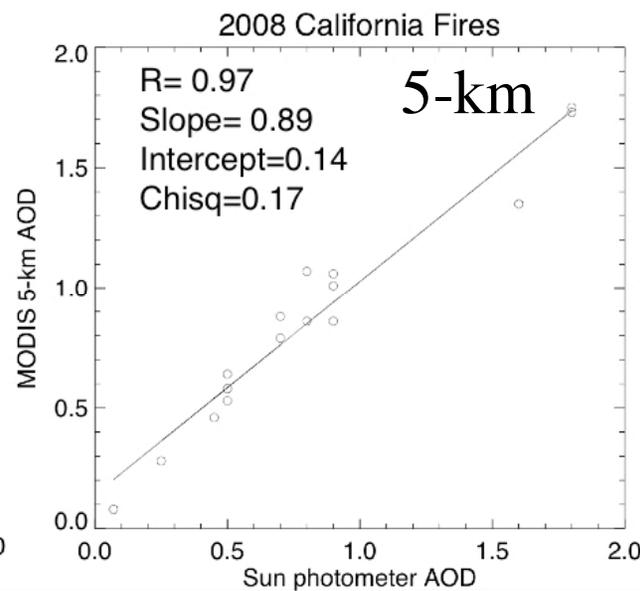
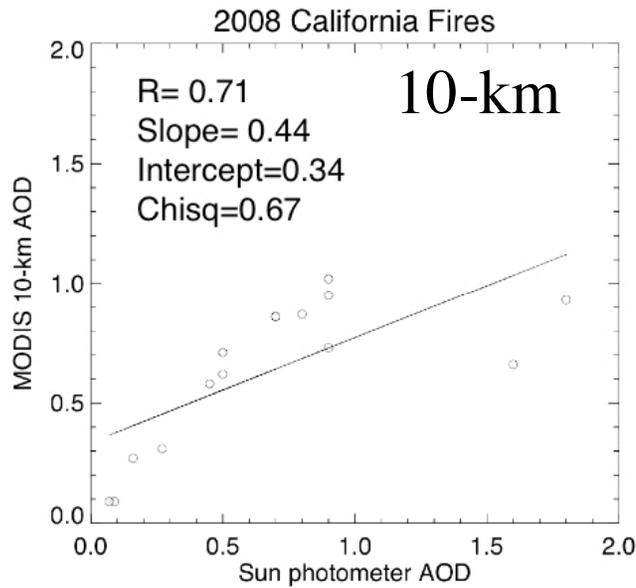
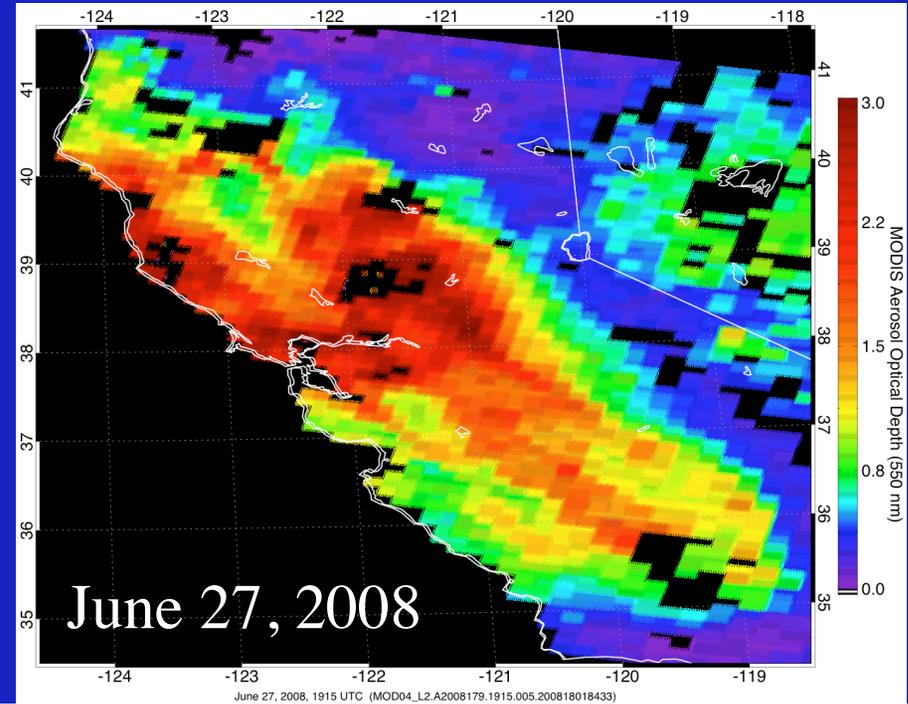




Aerosol Scattering Ratio Over SCAB- DC-8 Dial Lidar



High-resolution AOD Retrievals Better Perform During CARB





ARCTAS-CARB accomplishments

Satellite validation: Terra, Aqua, Aura under flights

Emissions of Greenhouse Gases and Aerosols: Extensive low level sampling of emissions across the Southern California Air shed, Central Valley, and offshore shipping lanes

- Urban emissions for several population centers
- Shipping emissions in offshore shipping lanes and harbors
- Agricultural emissions associated with crops, feedlots, dairies,
- Industrial emissions (e.g., refineries)
- Natural emissions from oceanic and terrestrial sources
- Transboundary pollution from Asia and Mexico
- Wildfire emissions from extensive fires

Air Quality Modeling and Prediction:

- Complete characterization of aerosols & ozone precursors useful for evaluating air quality models
- Establishing boundary conditions for use in CA regional air quality models and to test global models useful for providing BCs



Photo Credit: W. Liao