UCDAVIS
UNIVERSITY OF CALIFORNIA

Aerosol Chemistry and Processing at Mt. Bachelor Summit: Influences from Wildfire Plumes

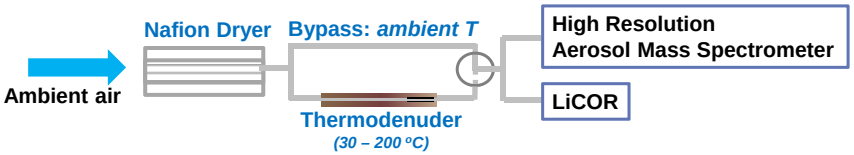
Shan Zhou, Sonya Collier, *Qi Zhang*
Dept. of Environmental Toxicology, University of California, Davis
Tim Onasch, Douglas Worsnop
Aerodyne Research Inc. Billerica
Nicole Wigder, Jonathan Hee, Dan Jaffe
Dept. of Atmos. Sci., University of Washington, Seattle
Art Sedlacek, Larry Kleinman
Brookhaven National Laboratory, Upton

U.S. DEPARTMENT OF ENERGY

ASR Atmospheric System Research

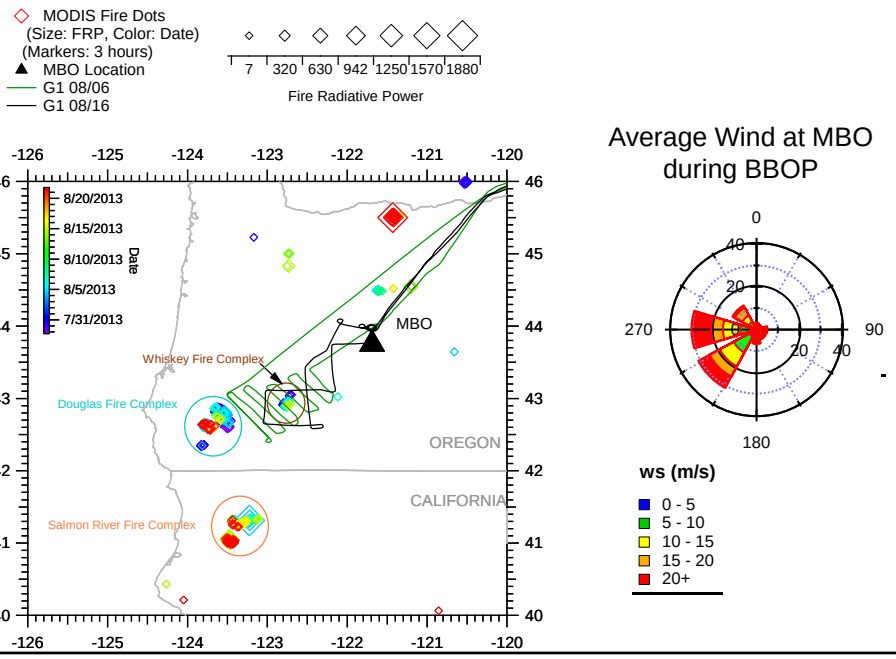
Deployment at Mt. Bachelor Observatory (MBO)

2.7 km a.s.l., 07/25 – 08/25, 2013

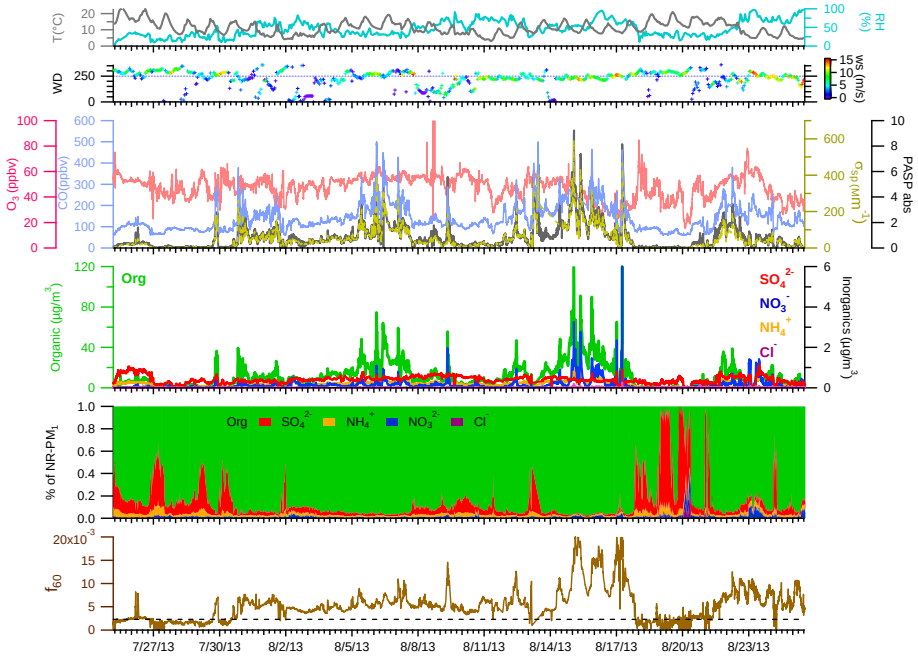


- Aerosol light extinction, EC/OC, BC
- O_3, CO, CO_2, NO_x, NO_y, VOCs, PAN
- Meteorological data
- Mercury …

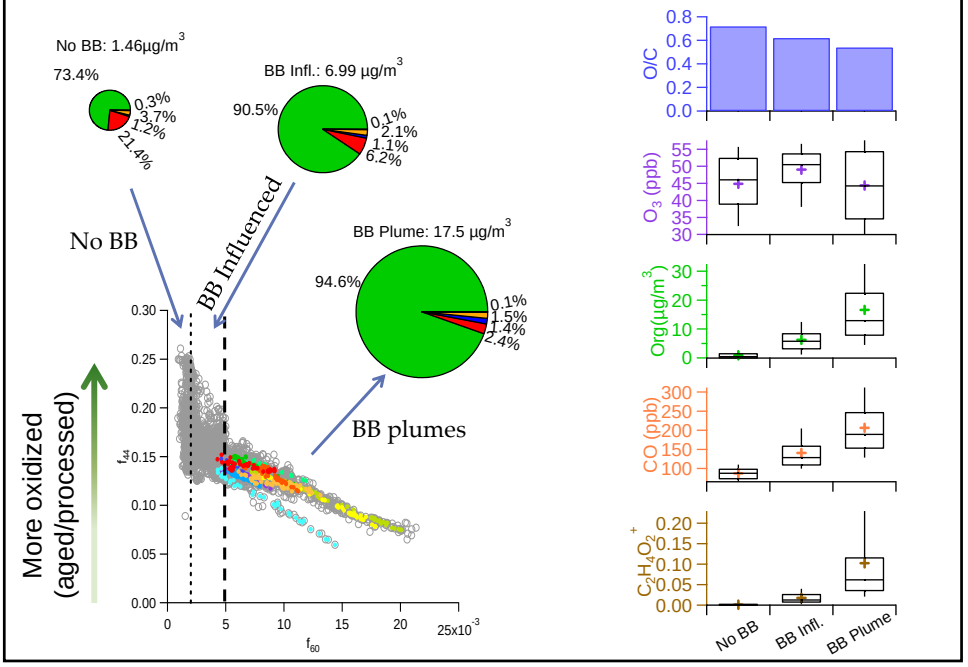
MODIS Fire Dots: July 25 - August 25, 2013



Overview of MBO Observations



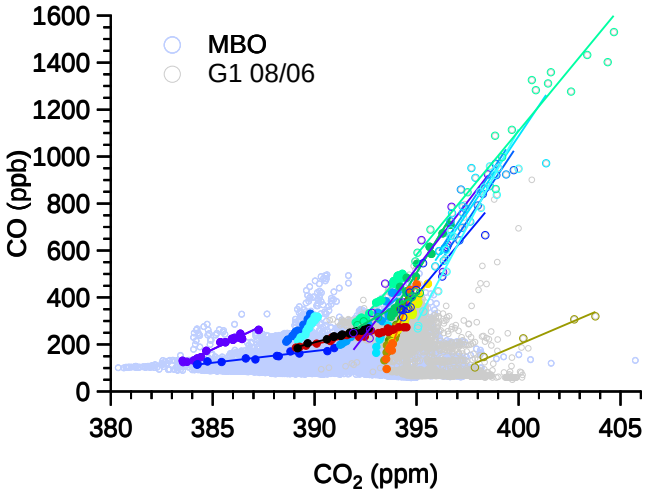
Influence of BB on Aerosol Chemistry



Modified Combustion Efficiencies of Plumes

$$MCE = \frac{\Delta CO_2}{\Delta CO + \Delta CO_2}$$

MBO: 0.81 – 0.98
G1: 0.86 – 0.92



Modified Combustion Efficiency (MCE)

$$\frac{\Delta CO_2}{\Delta CO + \Delta CO_2}$$

Smoldering combustion: CO, CH_4, OVOC, OC, etc.

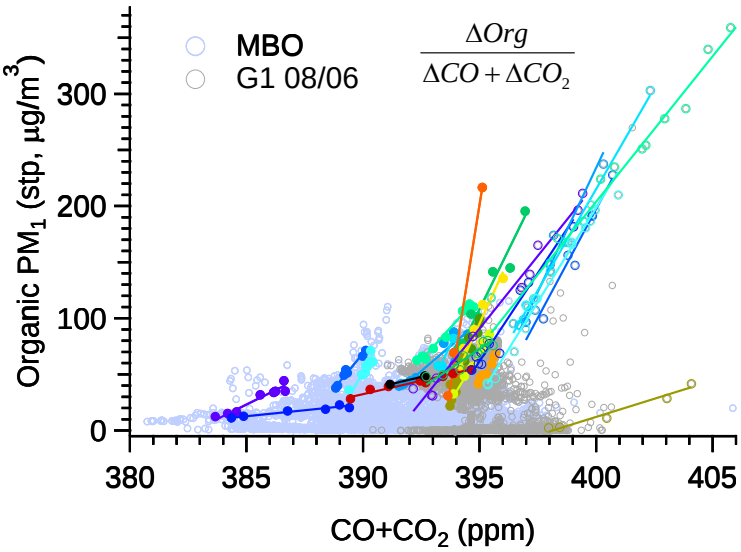
Flaming combustion: NO, CO_2, EC, etc.

smoldering MCE ~ 0.80

wildland fires vary along spectrum over time

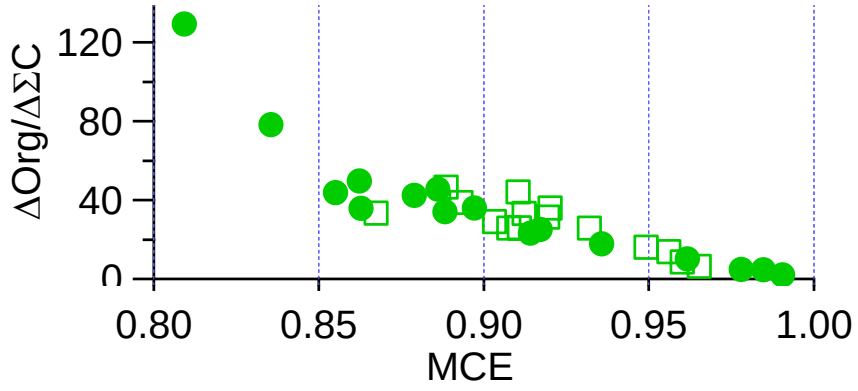
flaming MCE ~ 1.00

Enhancement of OA in Wildfire Plumes

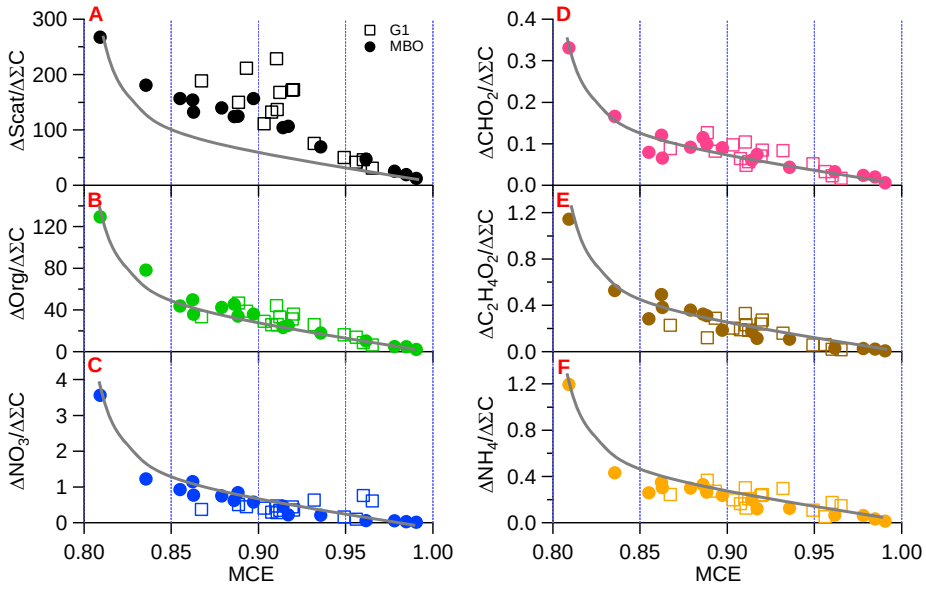


- Enhancement of OA relative to amount of fuel combusted varies significantly from plume to plume.

OA Emission Depends on MCE



MCE Dependent Aerosol Chemistry



Conclusions

- Wild fire plumes were frequently observed.
- Sampled various wildfire plumes from MBO using a HR-ToF-AMS with complimentary gas and particle-phase instrumentation
- Wildfire plumes strongly influence ambient PM loading and composition.
- Wildfire plumes characteristics:
  - > 90% of PM is organic
  - Variable MCE
  - $\Delta OA / (\Delta CO+\Delta CO_2)$ varies largely in individual plume
  - $\Delta PM / (\Delta CO+\Delta CO_2)$ anti-correlate with MCE