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Insights from the CARES Campaign in Northern California - Biogenic SOA formation and roles in New Particle Growth

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Introduction

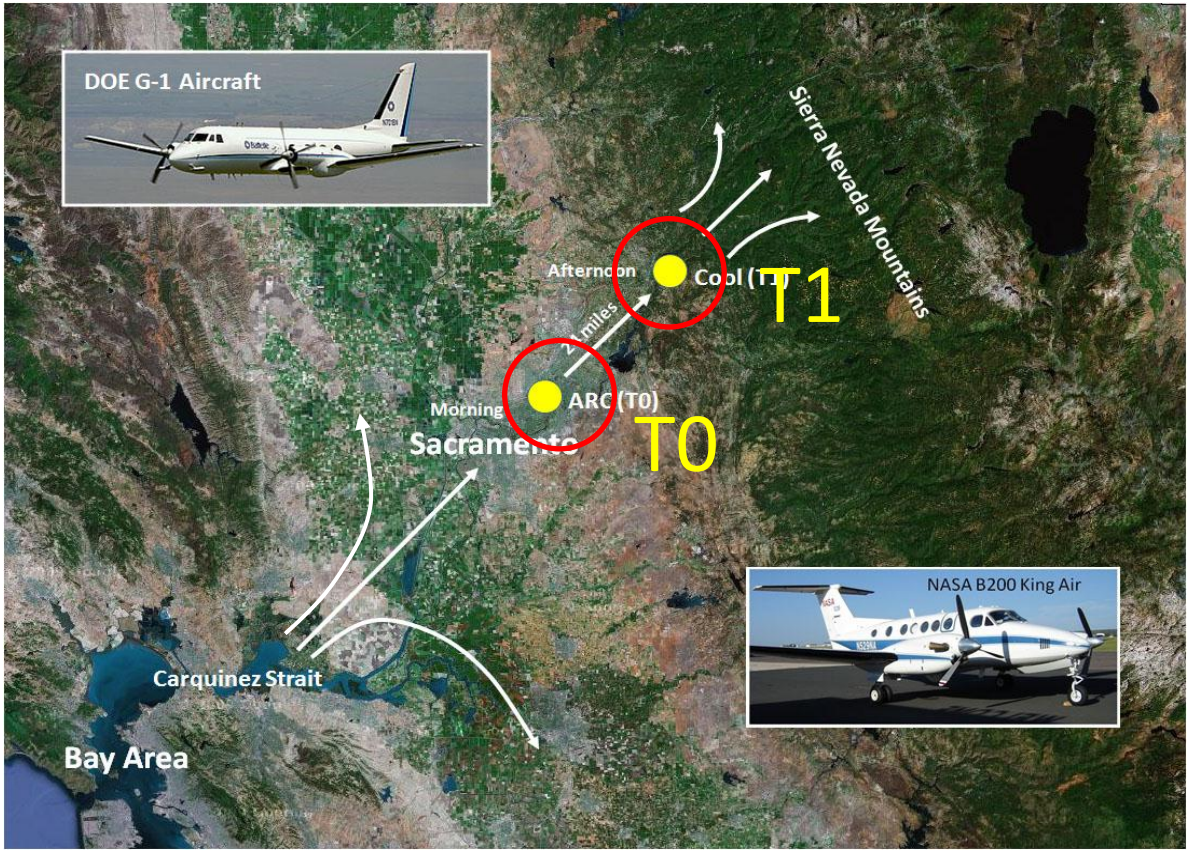
Carbonaceous

Aerosols and

Radiative

Effects

Study

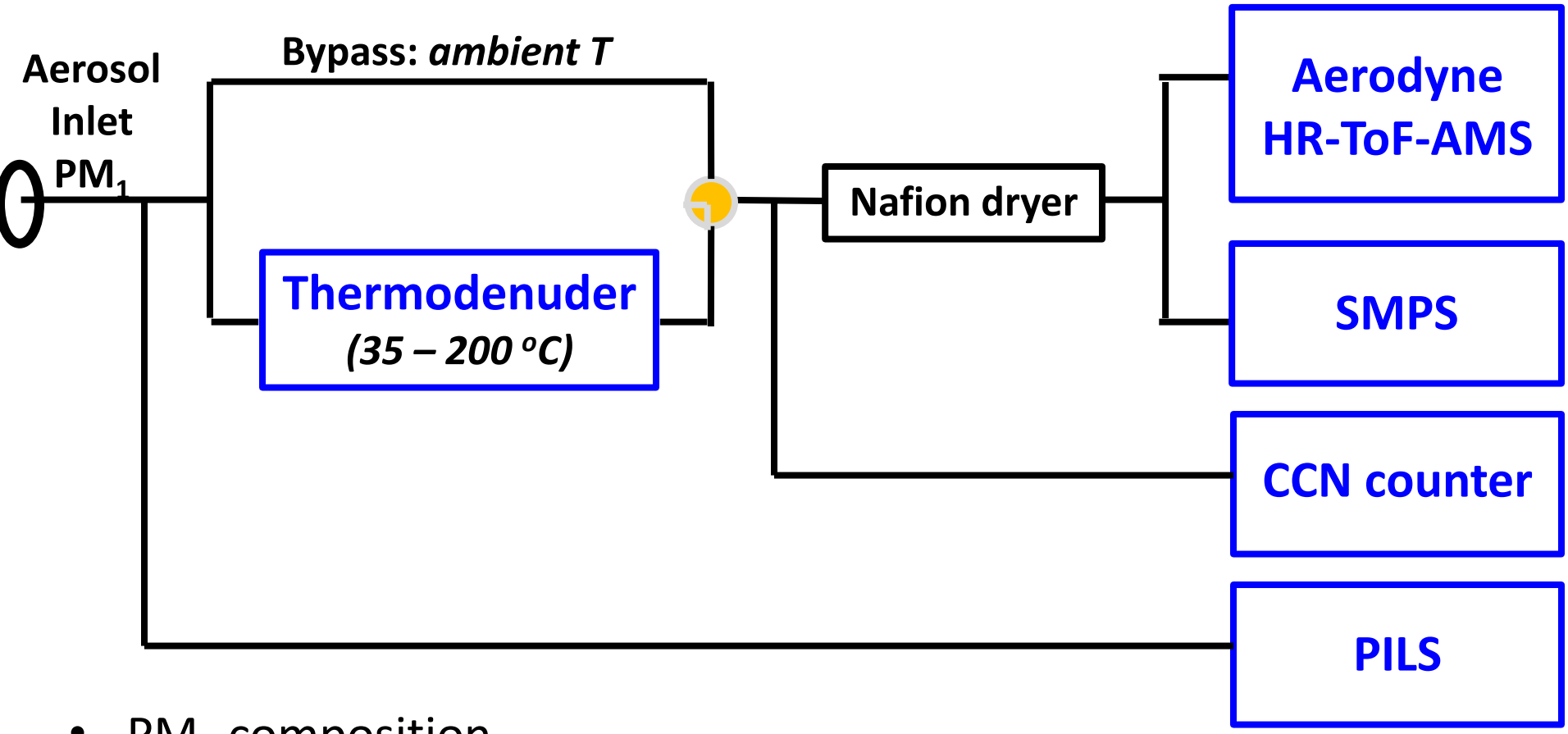


Objectives: - To investigate the evolution and aging of carbonaceous aerosols (anthropogenic and biogenic);

- To use field data to improve models.

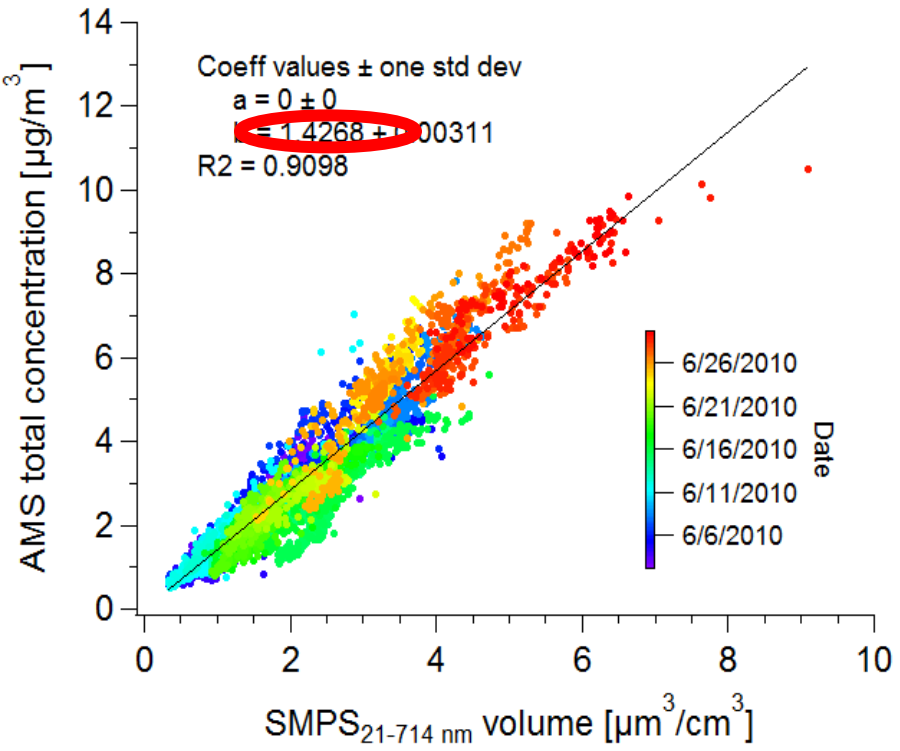
Instrumentation

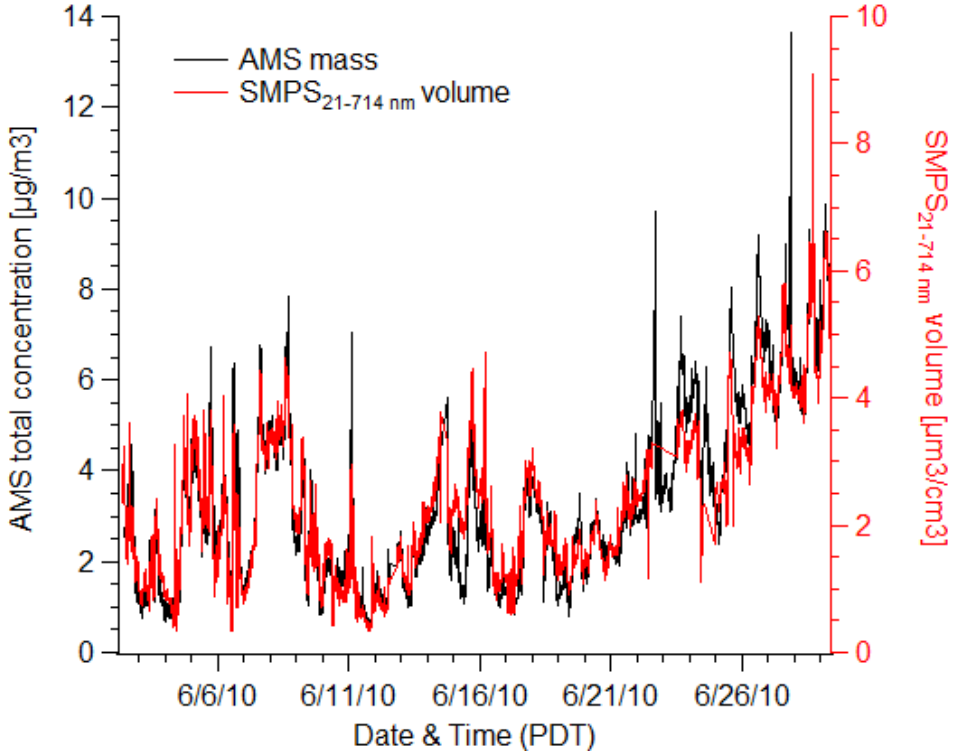
TD – AMS / SMPS



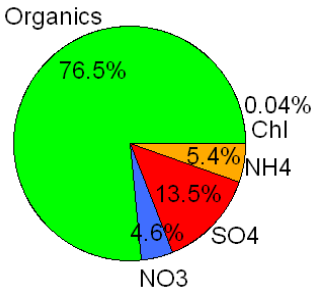
- PM_1 composition
- Size distributions (number and chemical species)
- Volatility distribution

AMS mass agree well with SMPS volume
PM_1 density = 1.4





PM_1 concentration, composition & size vary dynamically

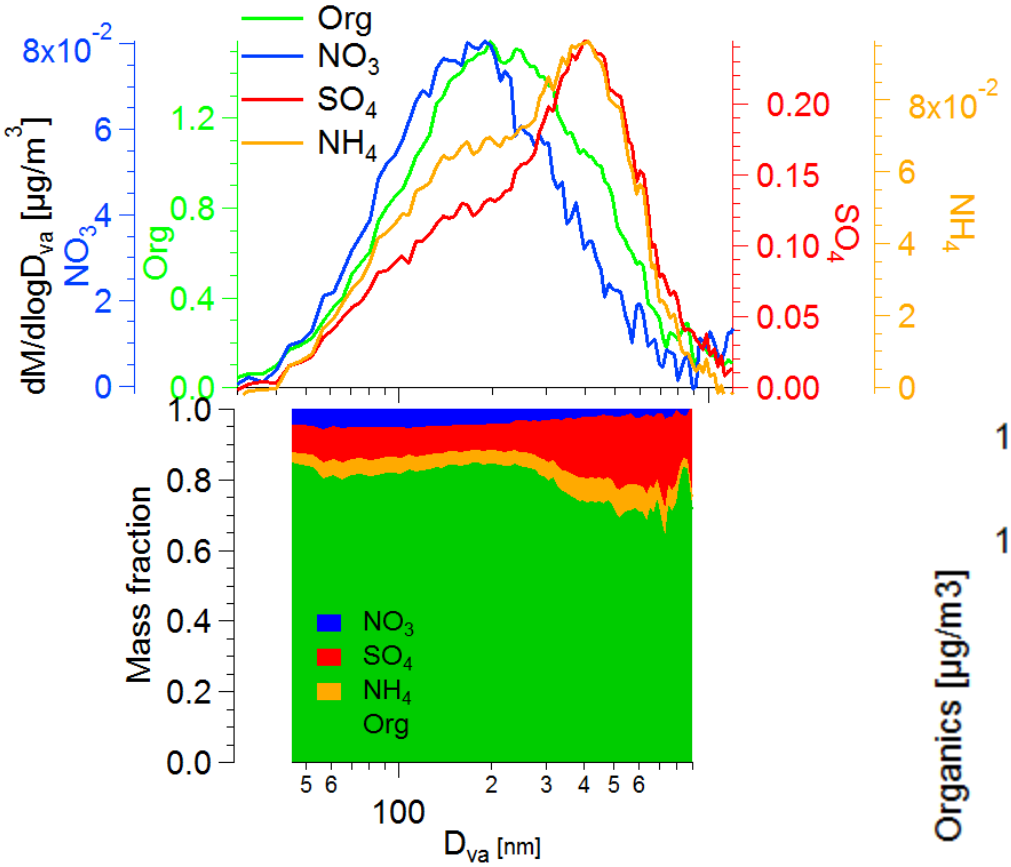


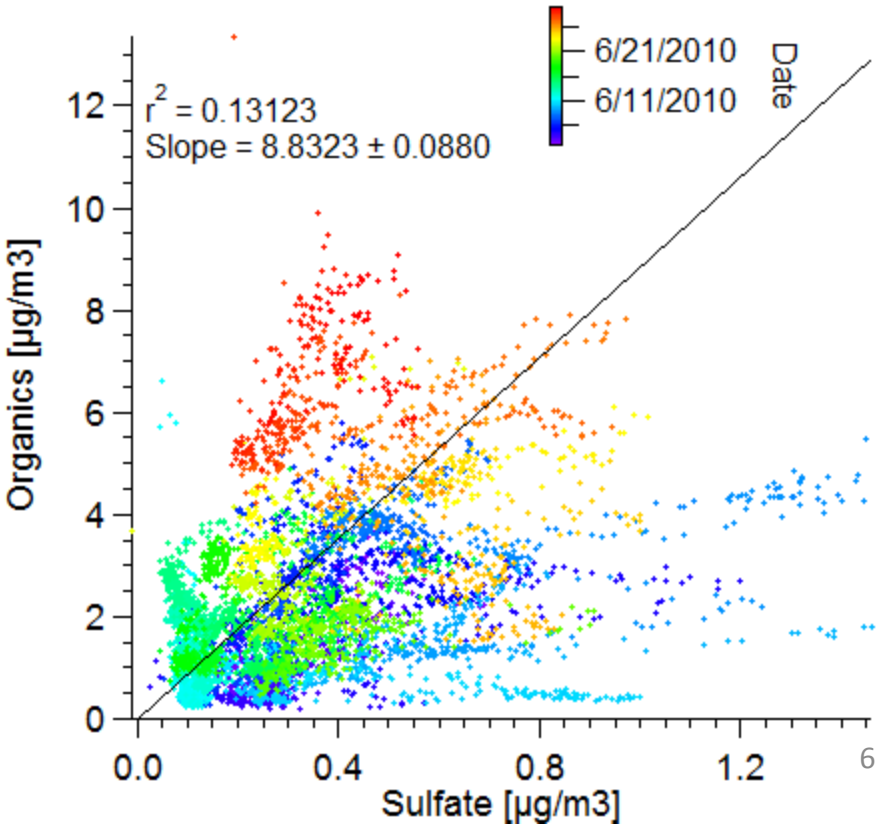
Organics dominate PM_1 composition

Temperature [°C]
RH [%]
CO2 [ppm]
O3 [ppb]
NOx [ppb]
Dp [nm]
dN/dlogDp [#/cm3]
Concentration [µg/m3]
Total mass loading:
Avg = 3.0 [µg/m3]
% contribution
Org
NO3
SO4
NH4
Chl
6/6/10
6/11/10
6/16/10
6/21/10
6/26/10
Date & Time (PDT)

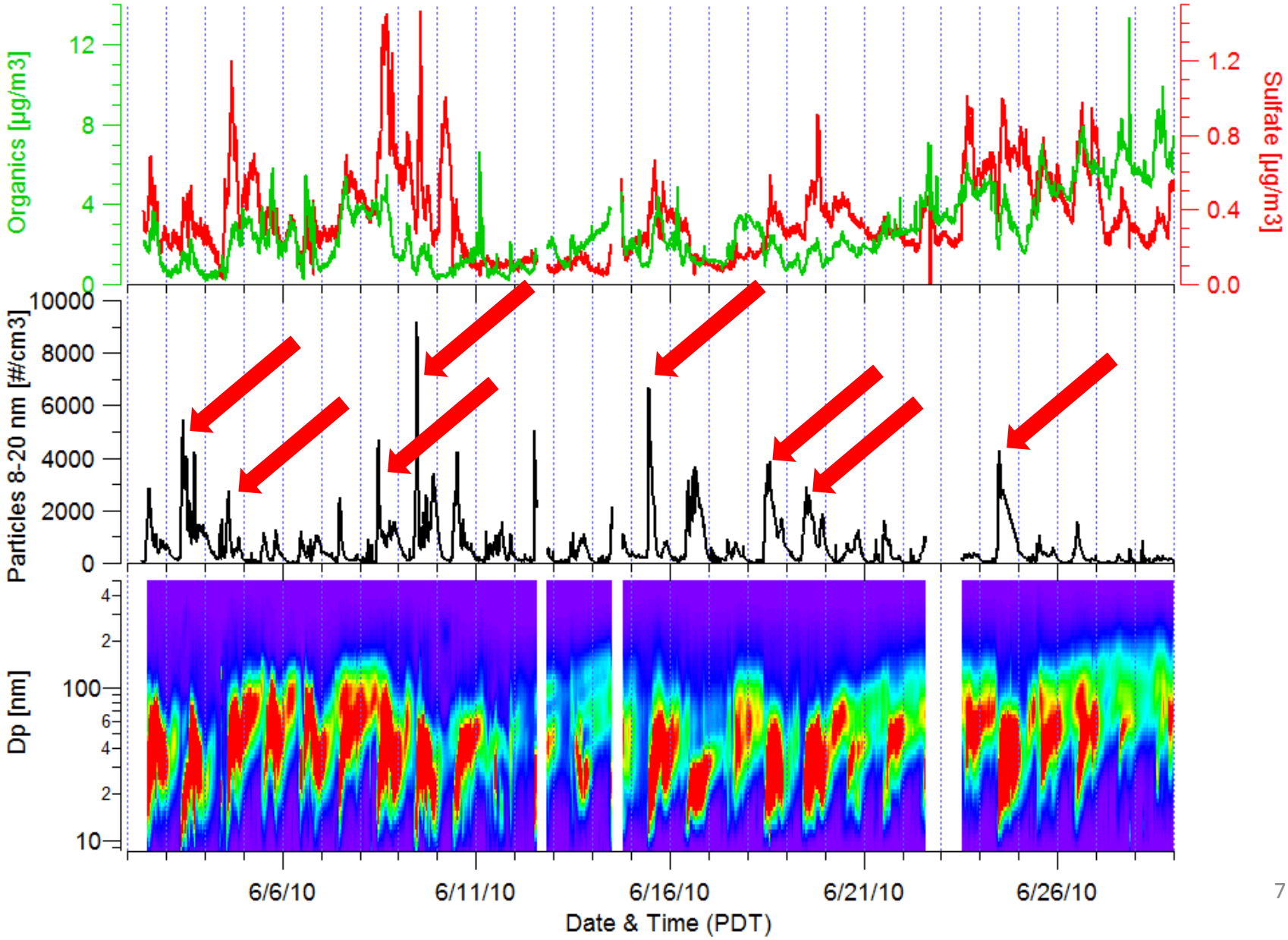
CO2 and O3 data: B. Flowers, M. Dubey

Sulfate and organics are externally mixed, due to different sources and formation mechanisms

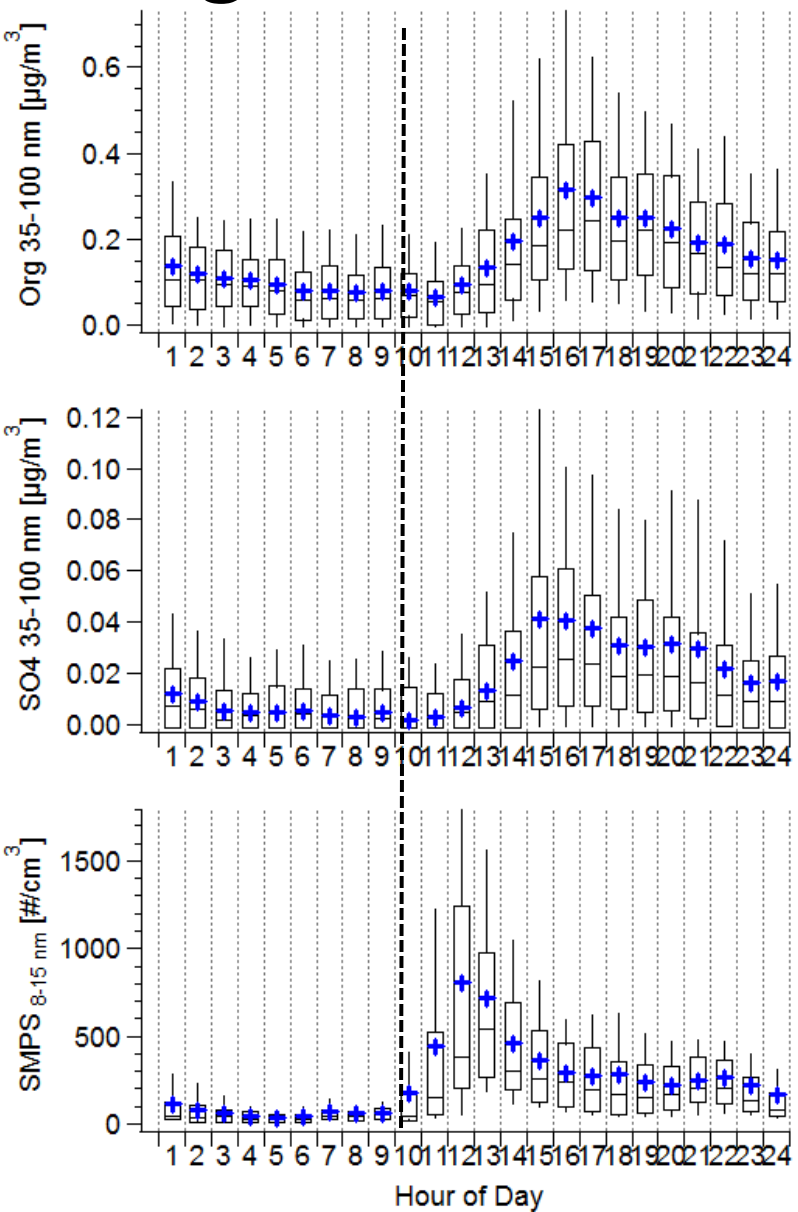


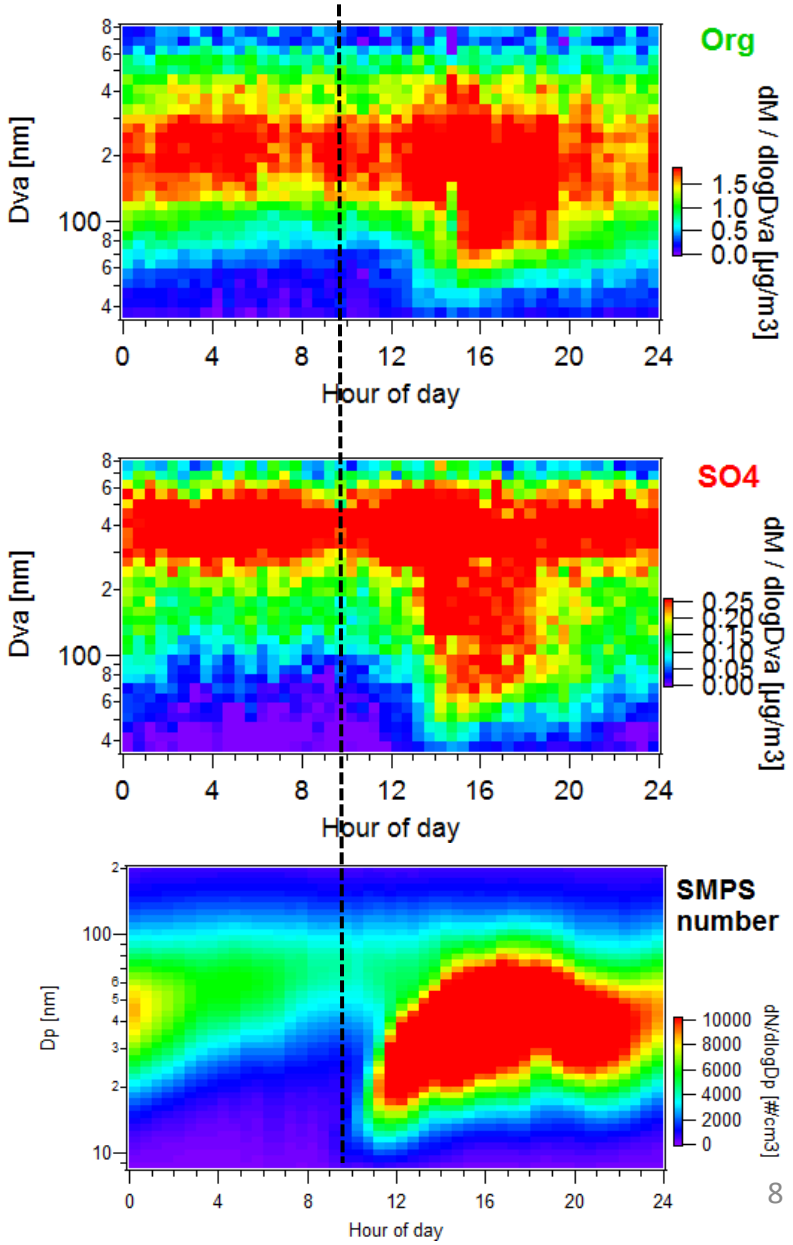


New particle formation & growth events

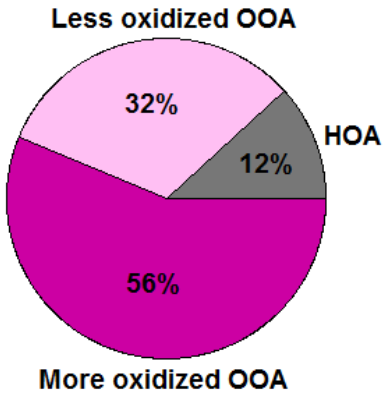


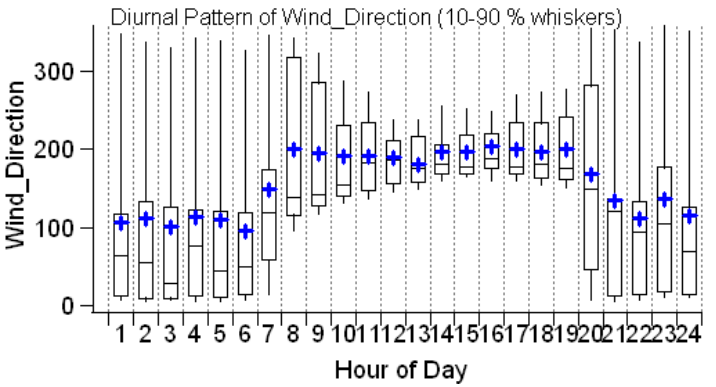
Organics and sulfate are important in new particle growth

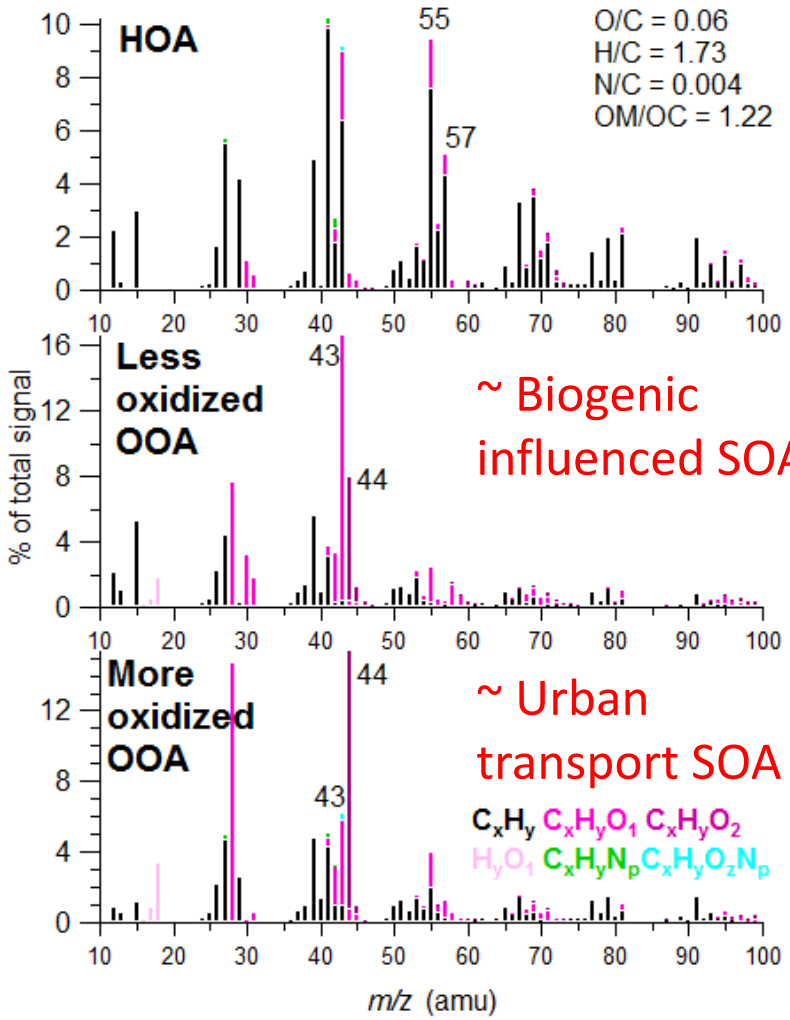




PMF analysis of HR spectra



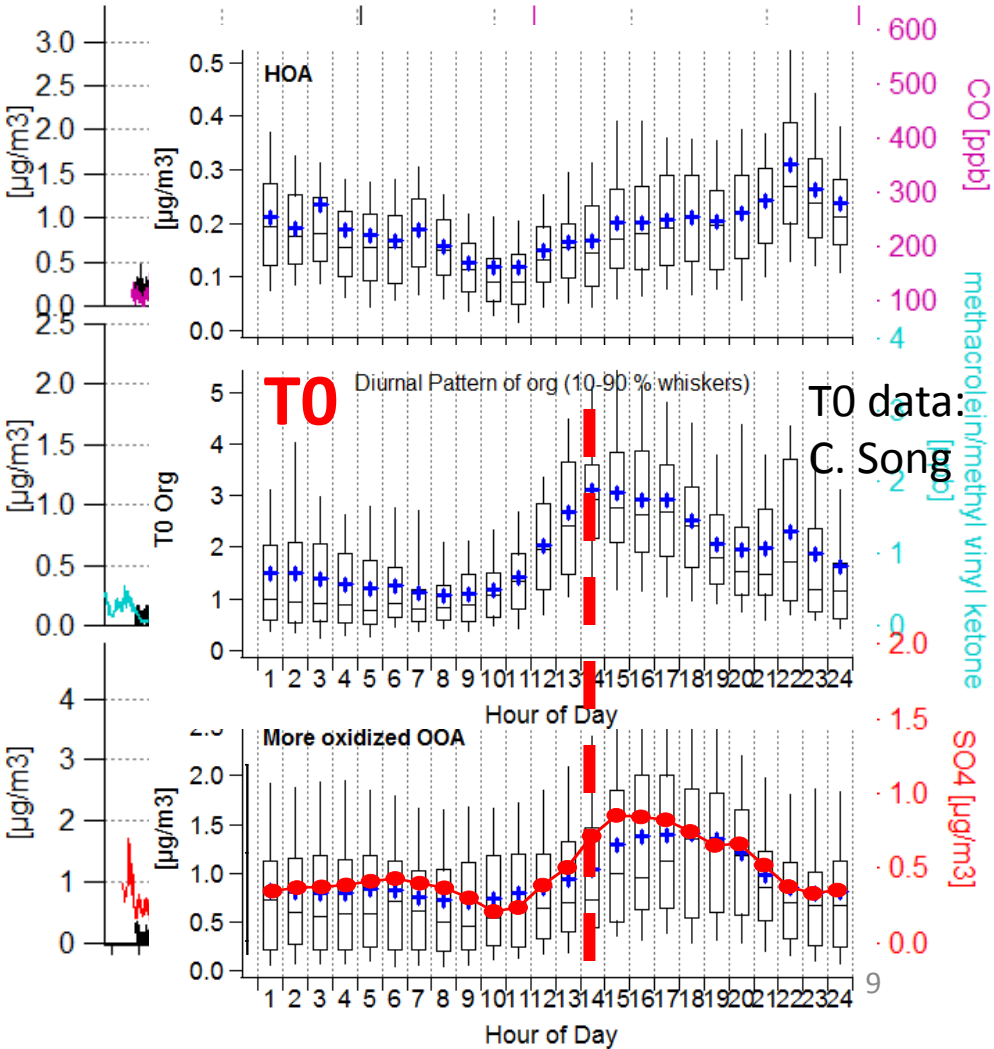




~ Biogenic influenced SOA

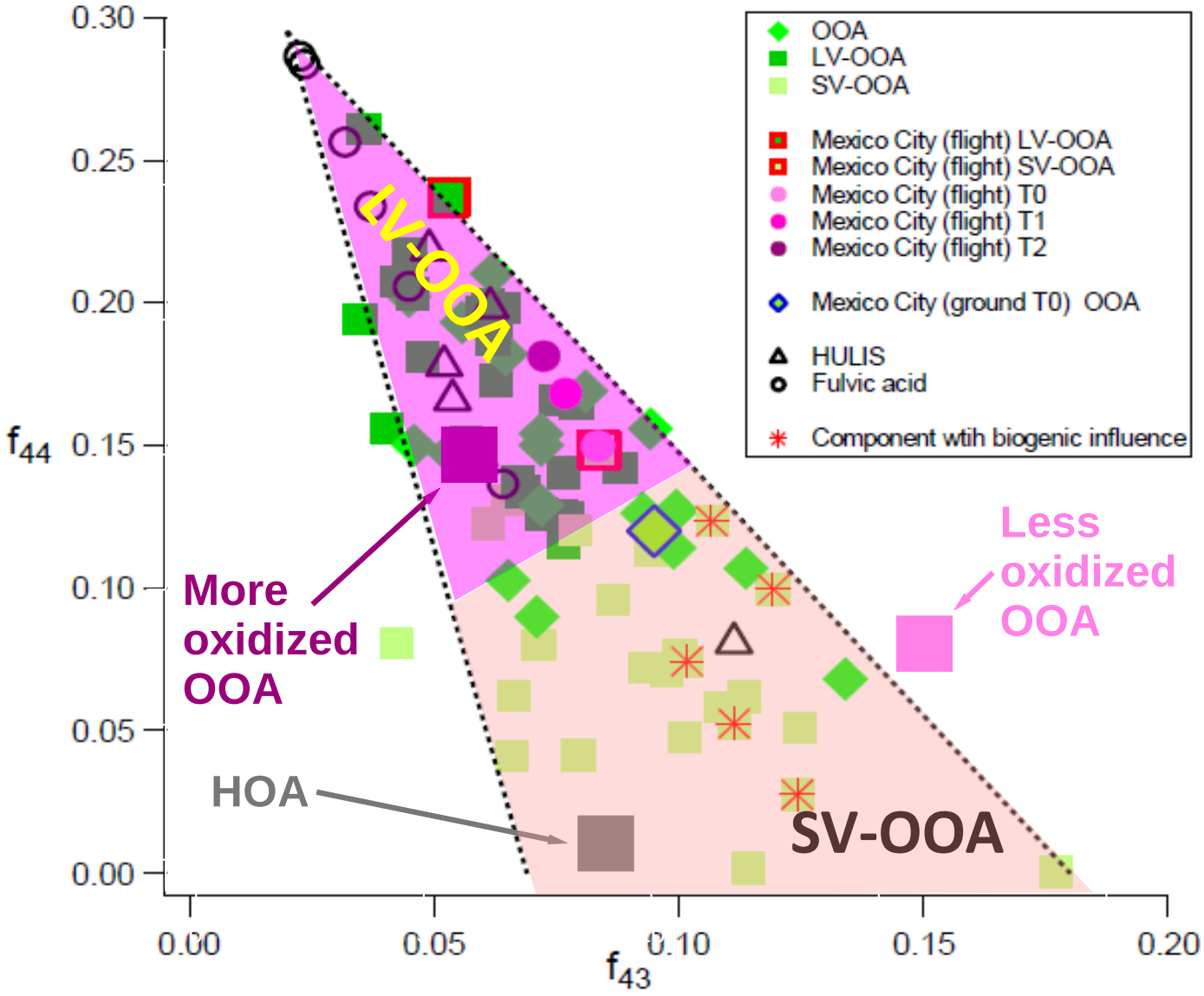
~ Urban transport SOA

C_xH_y $C_xH_yO_1$ $C_xH_yO_2$
H_yO_1 $C_xH_yN_p$ $C_xH_yO_zN_p$



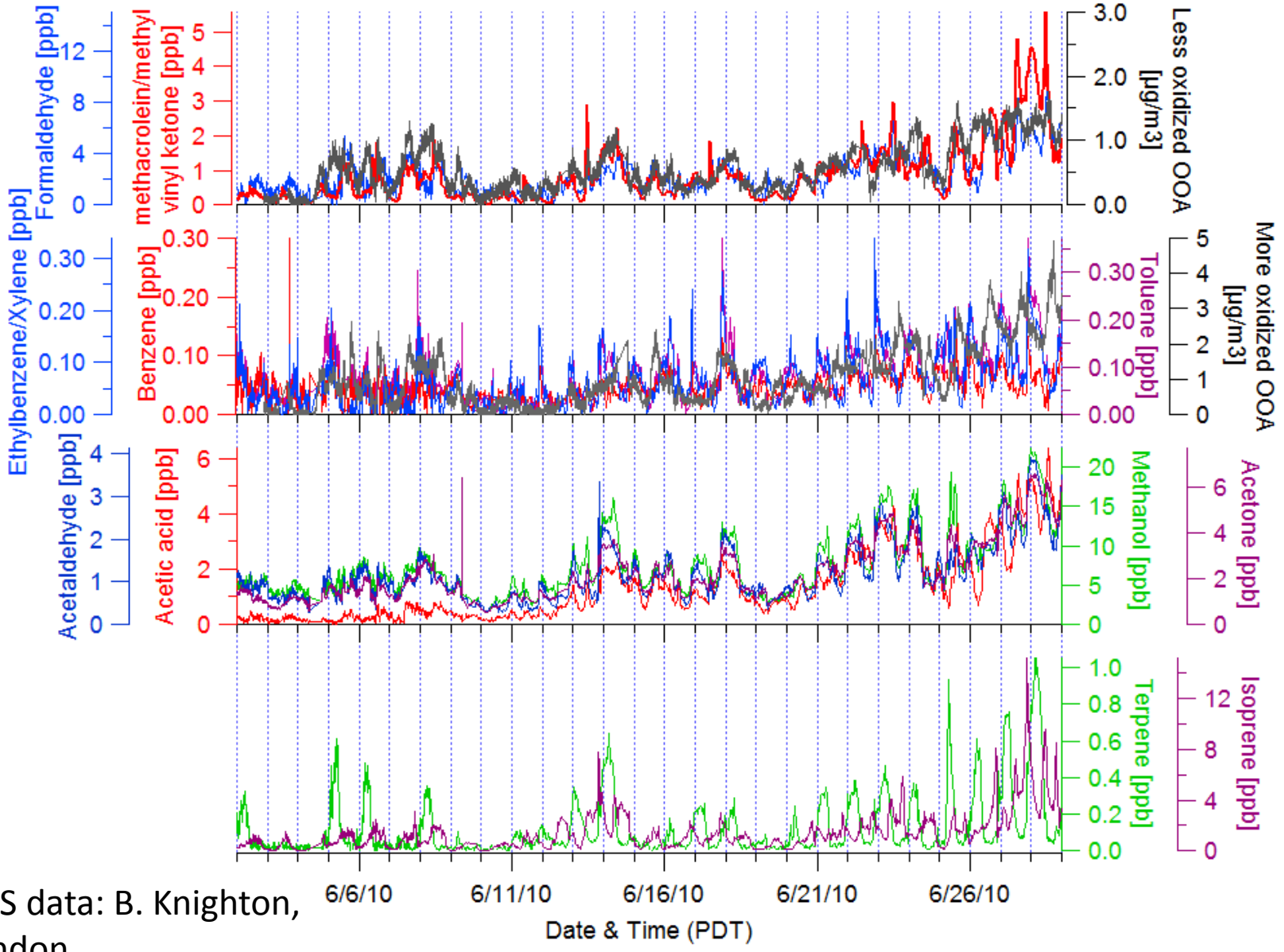
T0 data: C. Song

Biogenic influenced vs urban transport SOA



Ng et al., *Atmos Chem Phys*, 10 (10), 4625-4641, 2010.

Biogenic influenced vs urban transport SOA



PTR-MS data: B. Knighton, S. Herndon

Conclusions

- **Organics** (76%) are the major components of PM_1.
- Nucleation events observed almost every day. Both **organics** and **sulfate** play a key-role for the new particle growth
- 3 OA components identified by HR-PMF:
  - **OOA-1** (O/C = 0.47): 56%, Urban transport
  - **OOA-2** (O/C = 0.41): 32% Biogenic influenced
  - HOA (12%): combustion POA (local + transport)
- Unique case studies will be performed to study biogenic SOA production, SOA's role in new particle growth, and transport of urban plumes.

Acknowledgements

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Thank you for your attention

Any questions?