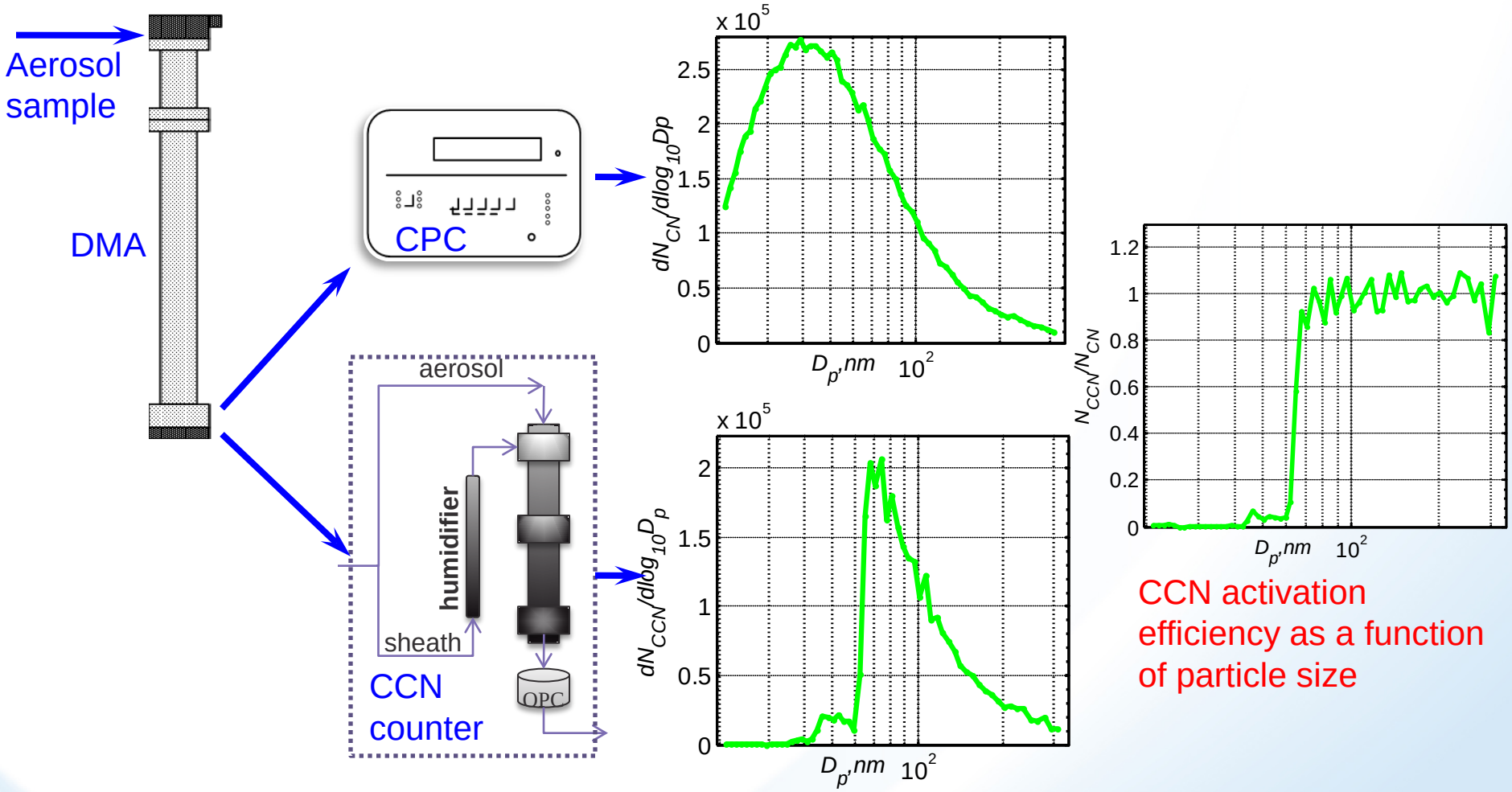
Cloud activation properties of organic aerosols observed at during CARES

Fan Mei and Jian Wang
Brookhaven National Laboratory

Measurements at T1 site:

- Cloud condensation nuclei (CCN) spectrum measured by a CCN counter (5 supersaturations: 0.19, 0.23, 0.30, 0.39, and 0.45%).
- Size-resolved CCN spectrum measured by DMA-CCN counter. (6 supersaturations: 0.15, 0.19, 0.23, 0.30, 0.39, and 0.45%).
- Aerosol size distribution (25-350 nm).

Measurements of Size-resolved CCN Spectrum



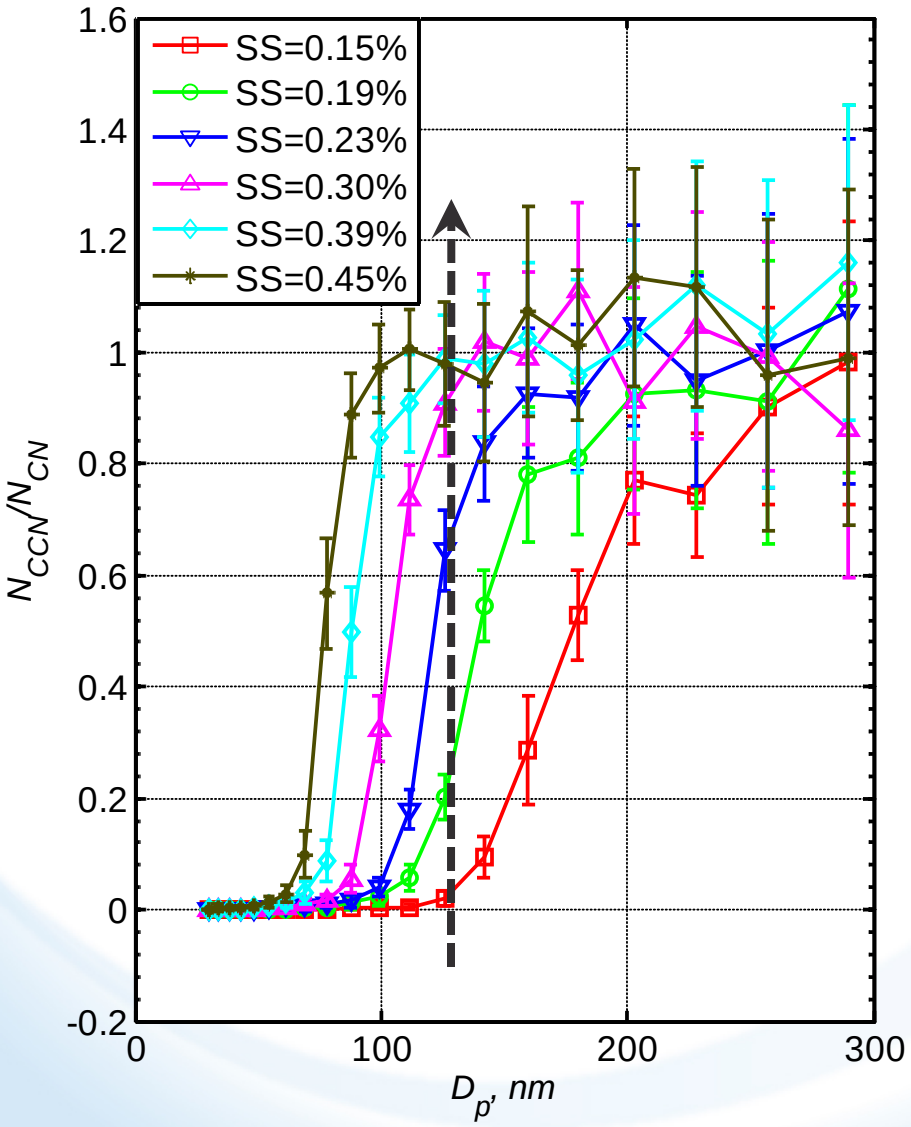
CCN activation efficiency as a function of particle size

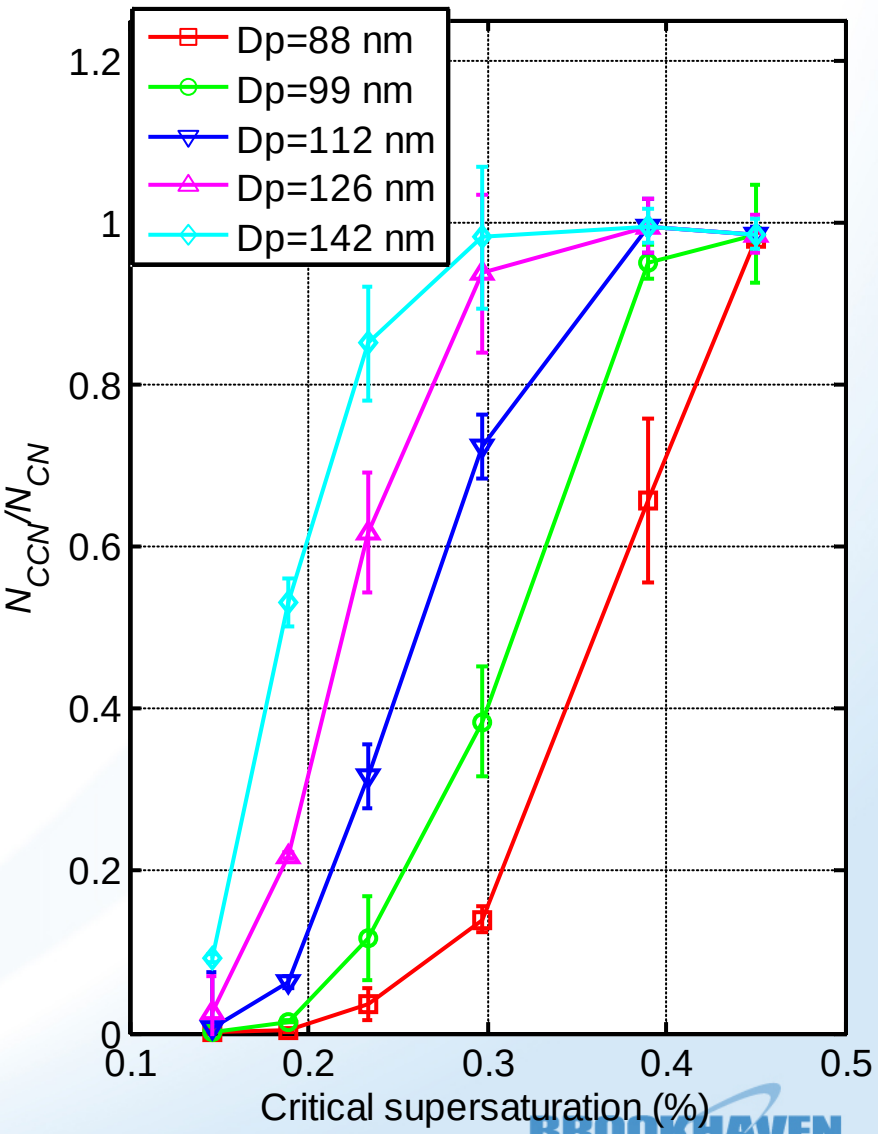
Supersaturation (*SS*): 0.15, 0.19, 0.23, 0.30, 0.39, 0.45%

Time resolution of the measurements: 40 min at each *SS*

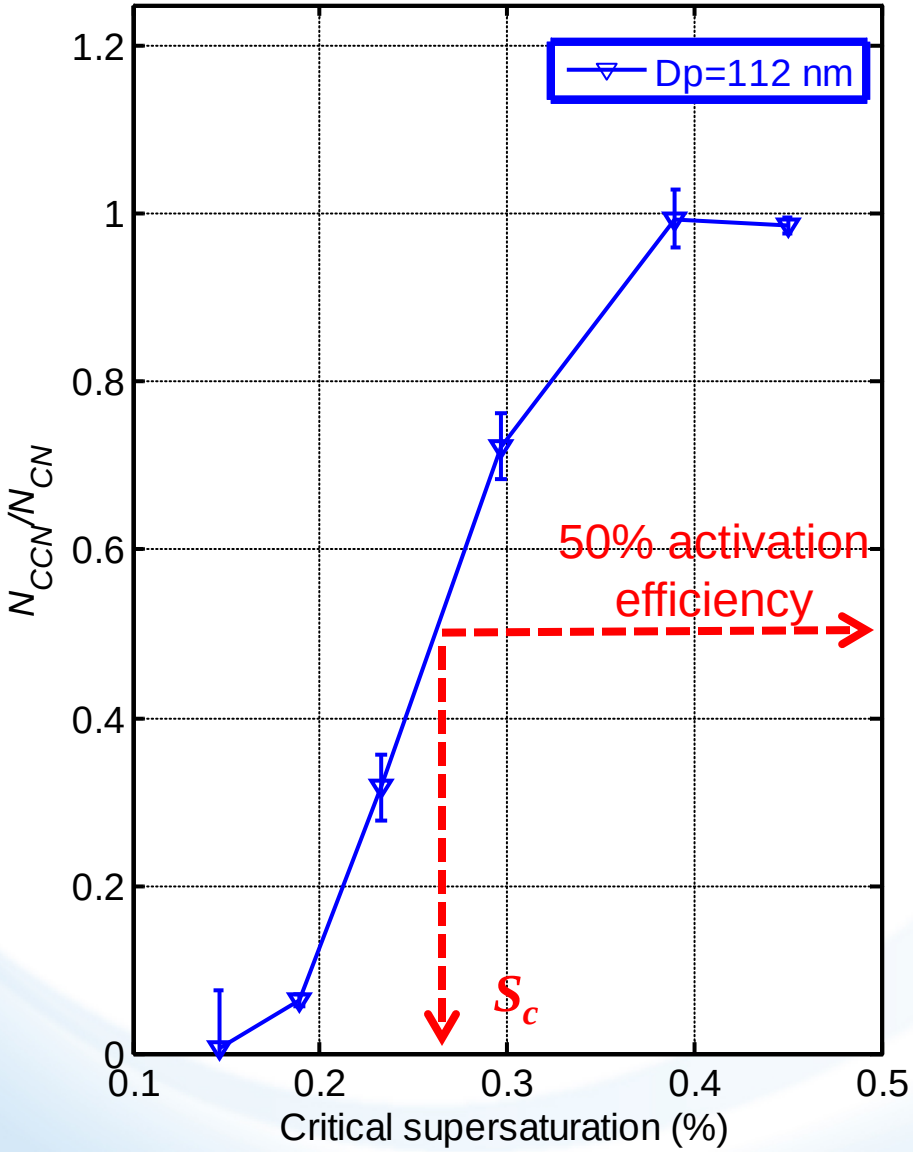
Particle size range: 25 - 350 nm

Size-resolved CCN activation efficiency





Derivation of particle hygroscopicity (κ_{CCN})



$$k_{CCN} = \frac{4A^3}{27 D_p^3 \ln^2 S_c}$$

$$\text{where } A = \frac{4 s_w M W_w}{R T r_w}$$

Hygroscopicity of organics (κ_{Org})

- κ_{Org} needs to be better constrained to reduce the large uncertainty in simulated aerosol indirect effects (Liu and Wang 2010, ERL).

- κ_{Org} is derived by subtracting the contribution of inorganic species from the overall particle hygroscopicity:

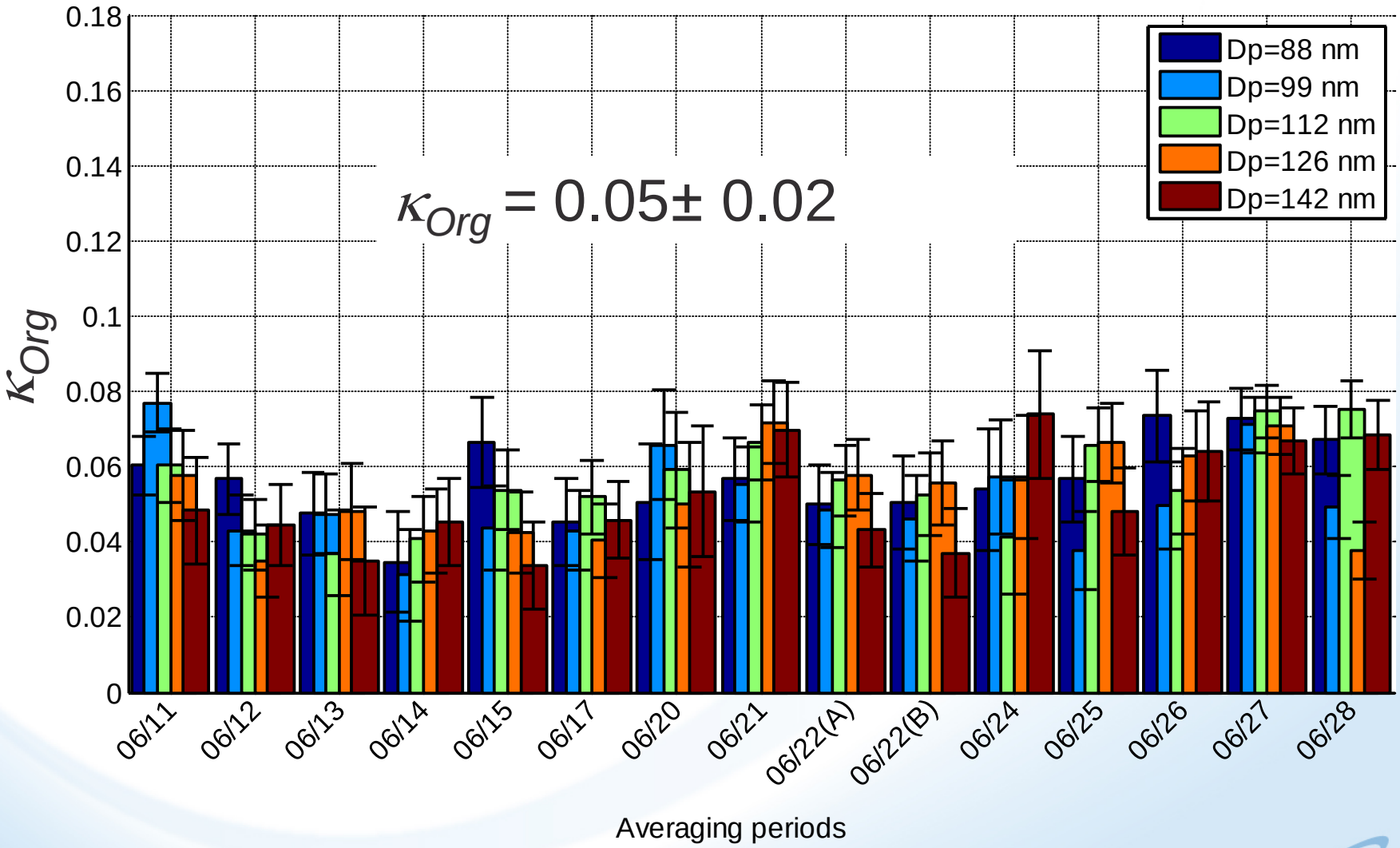
Derived from size-resolved activation efficiency

Well known

$$k_{Org} = \frac{1}{x_{Org}}\left(k_{CCN} - k_{NH_4NO_3}\, x_{NH_4NO_3} - k_{(NH_4)_2SO_4}\, x_{(NH_4)_2SO_4}\right)$$

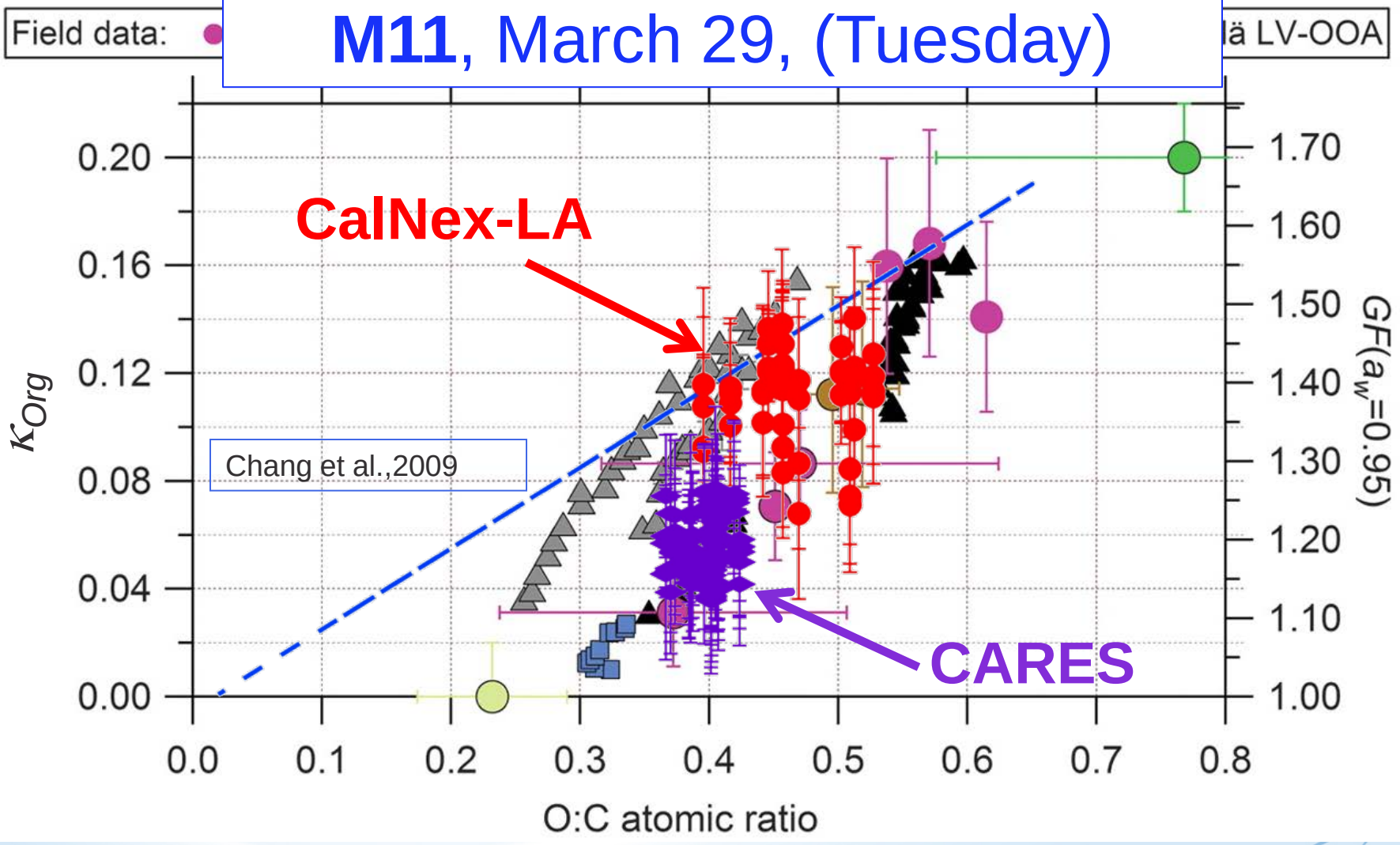
Volume fraction, derived from HR-Tof-AMS data, (Prof. Qi Zhang's group, UC Davis)

κ_{Org} at T1 site during CARES



κ_{Org} as a function of oxidation level

Poster: Mei et al.
M11, March 29, (Tuesday)



Jimenez, Canagaratna, Donahue, et al., Science 326, 1525 (2009)