

CCN activation properties of organic aerosol observed during Aerosol IOP at BNL

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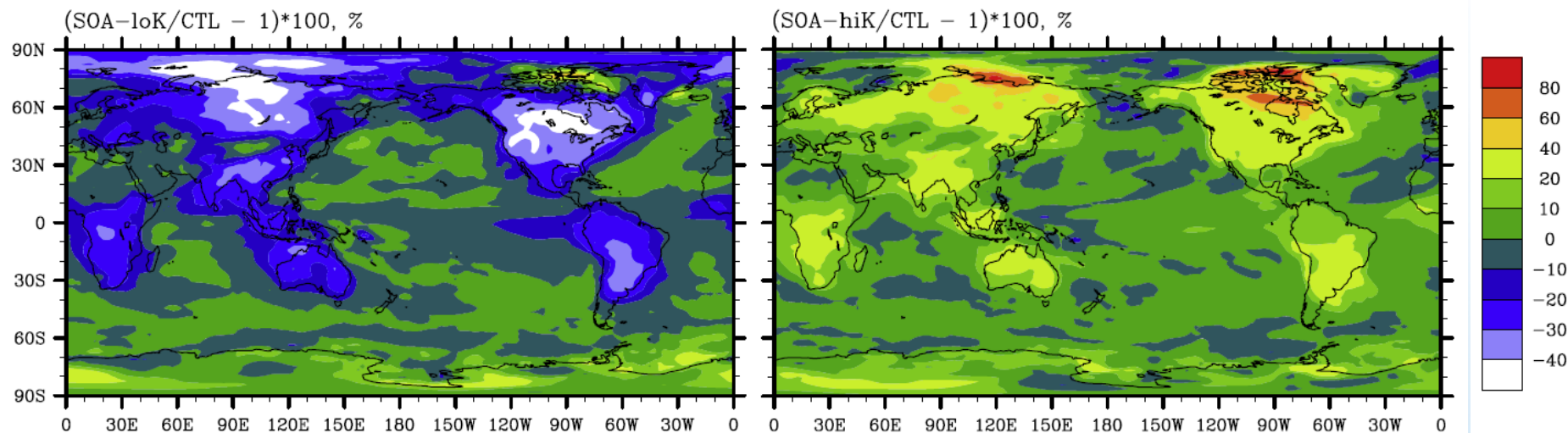
Strong influence of organic hygroscopicity (κ_{Org}) on simulated CCN concentration

Percentage change in CCN ($S=0.1\%$) near surface

κ_{Org} : 0.14 \rightarrow 0.07

Pre-industrial

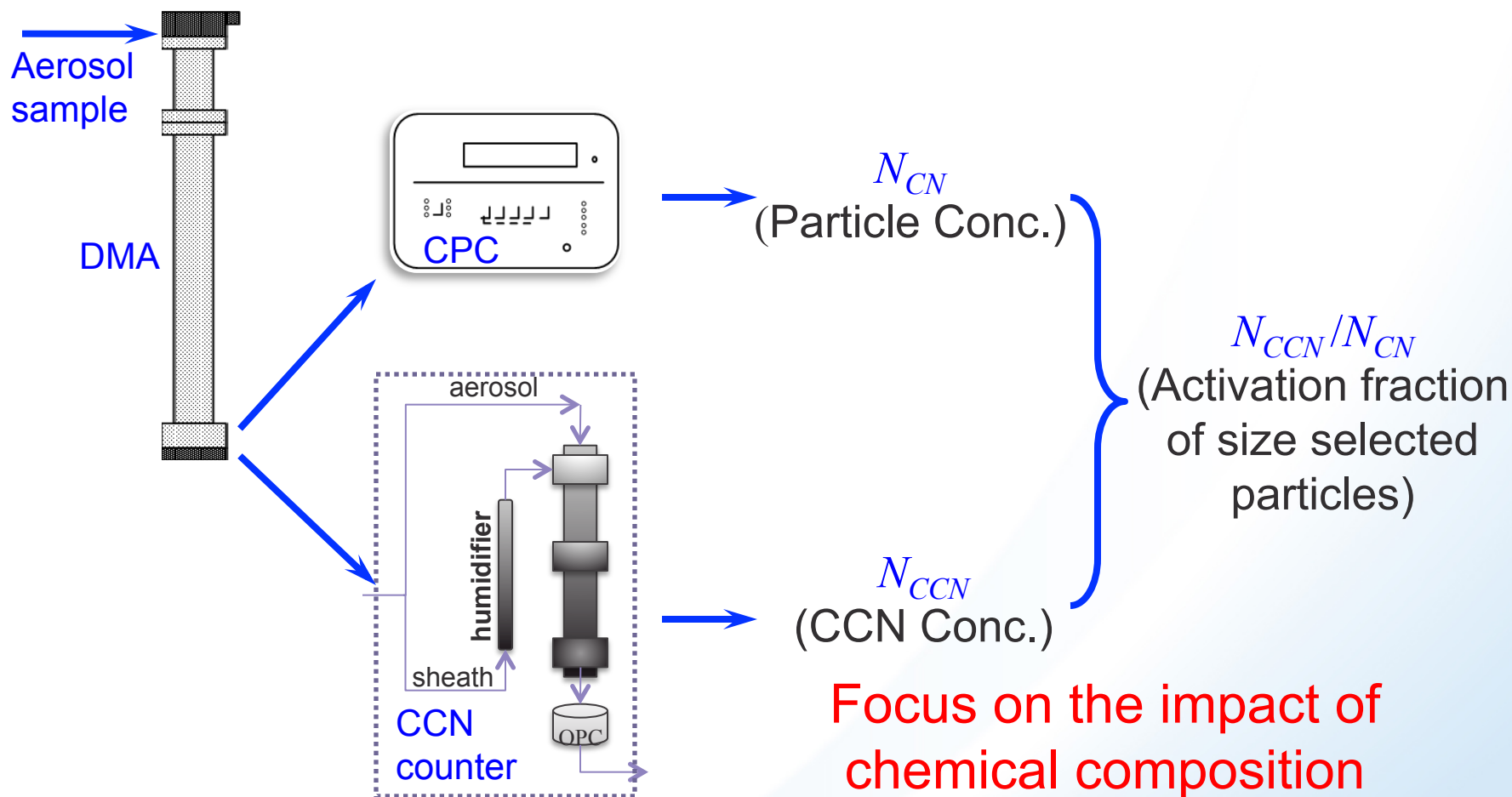
κ_{Org} : 0.14 \rightarrow 0.21



Liu and Wang, ERL, 2010

κ_{Org} strongly affects simulated CCN concentration and aerosol indirect forcing.

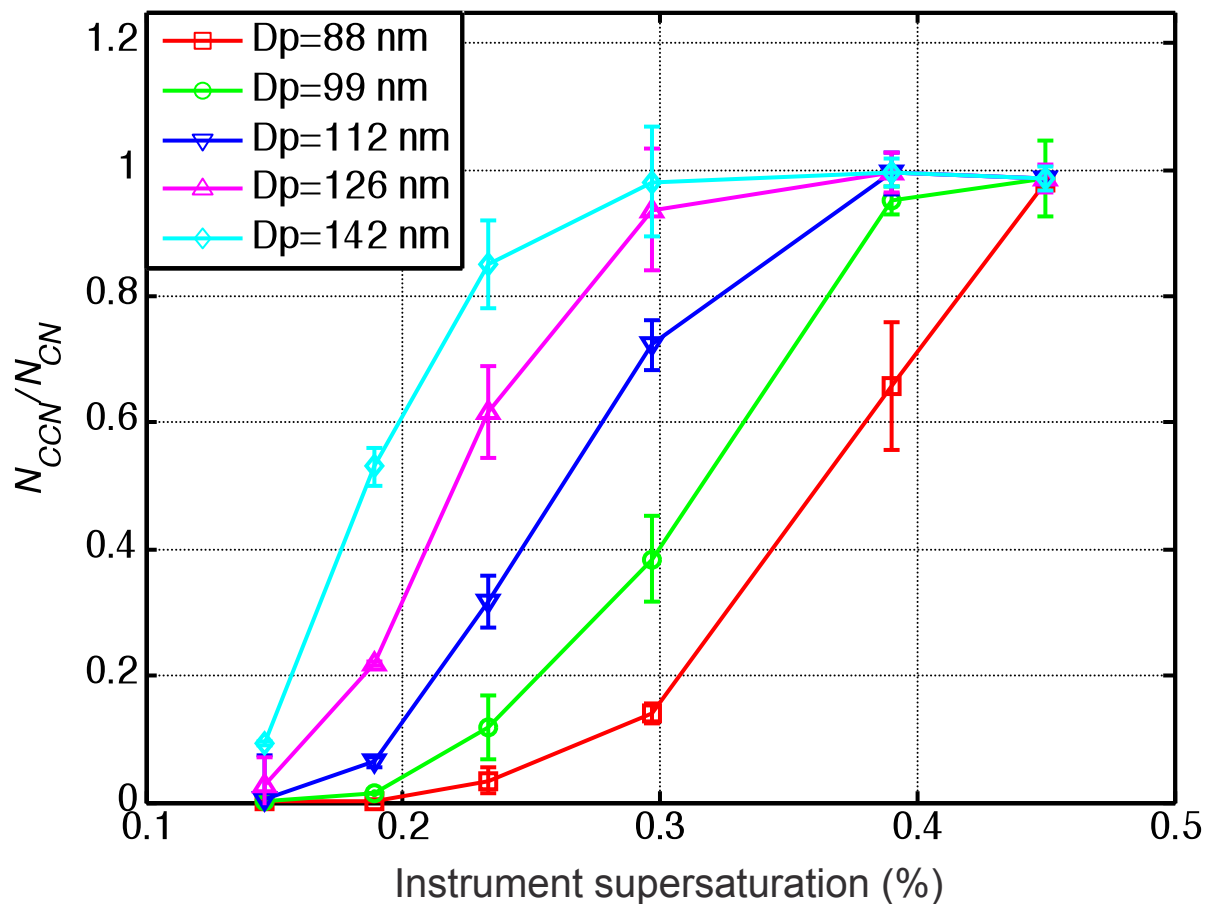
Size resolved CCN activation fraction



Supersaturation (SS): 0.115%, 0.150%, 0.202%, 0.250%, 0.317%,
0.409%, 0.500%, 0.787%

Particle size range: 80 - 250 nm

Size resolved CCN activation fraction



$$= \frac{E}{1 + \frac{k_{CCN}}{S_C} \frac{OH}{O_2}}$$

Cerully, et al., 2011

$D_p, S_C \rightarrow k_{CCN}$
 $k_{CCN} = \epsilon \frac{4A^3}{27D_p^3 S_C^2}$, where $A = \frac{4\sigma_w MW_w}{RT\rho_w}$

Hygroscopicity dispersion of size selected particles

Derivation of organic hygroscopicity (κ_{Org})

Particle hygroscopicity (κ_{CCN}):

$$k_{CCN} = \frac{4A^3}{27D_p^3 S_C^2}, \text{ where } A = \frac{4s_w MW_w}{RT r_w}$$

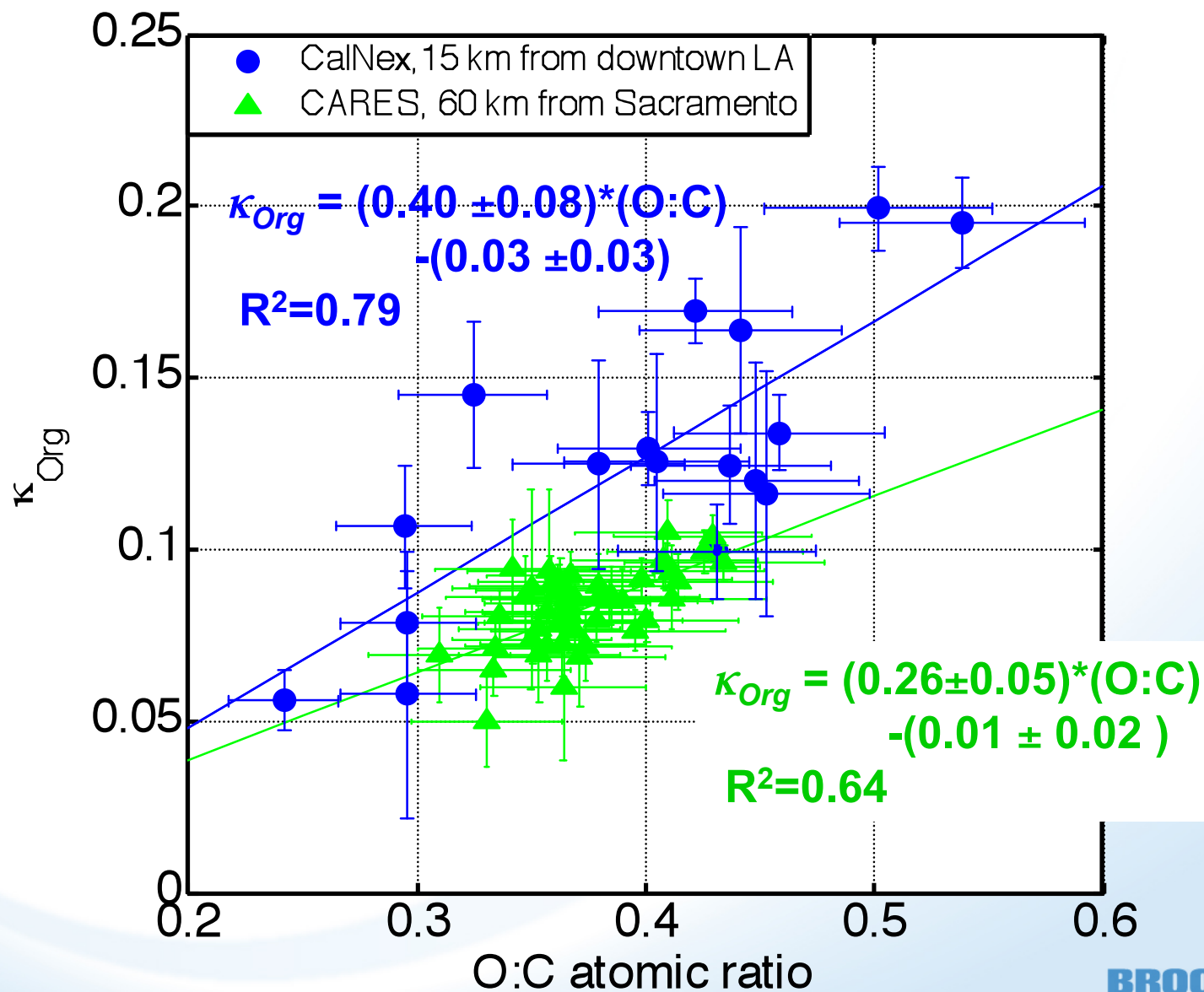
$$k_{CCN} = \mathring{\mathbf{a}} \sum_i x_i k_i \quad \text{where } x_i \text{ is the volume fraction of species } i.$$

Organic hygroscopicity (κ_{Org}):

$$k_{Org} = \frac{1}{x_{Org}} \left(k_{CCN} - \overset{0.61}{\downarrow} k_{\text{NH}_4\text{NO}_3} x_{\text{NH}_4\text{NO}_3} - \overset{0.67}{\downarrow} k_{(\text{NH}_4)_2\text{SO}_4} x_{(\text{NH}_4)_2\text{SO}_4} \right)$$

Size-resolved volume fraction derived from AMS data

K_{Org} as a function of organics O:C ratio



Plans:

- Examine the hygroscopicity of organic component of aerosols:
 - Longer sampling period
 - Sampling downstream a thermal denuder
 - Other major organics type
- Study the impact of organics on droplet growth kinetics