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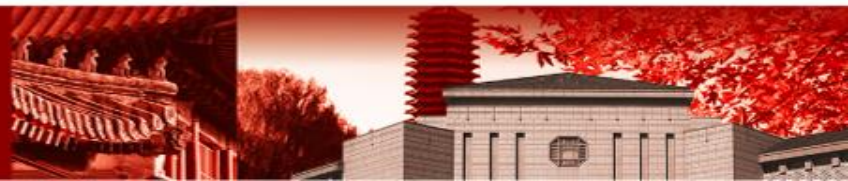
Burst and growth of ultrafine particles during the biomass burning episodes

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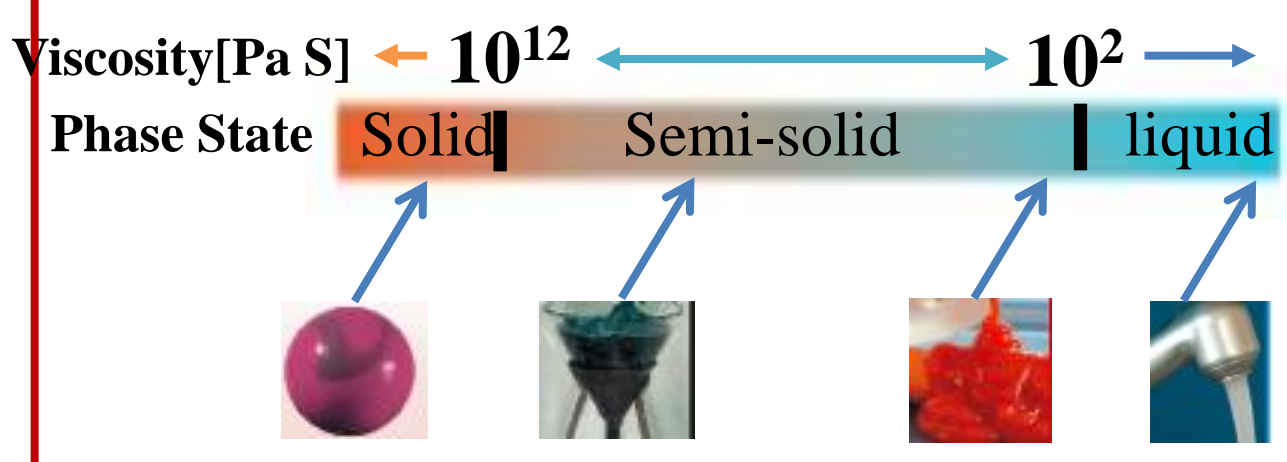
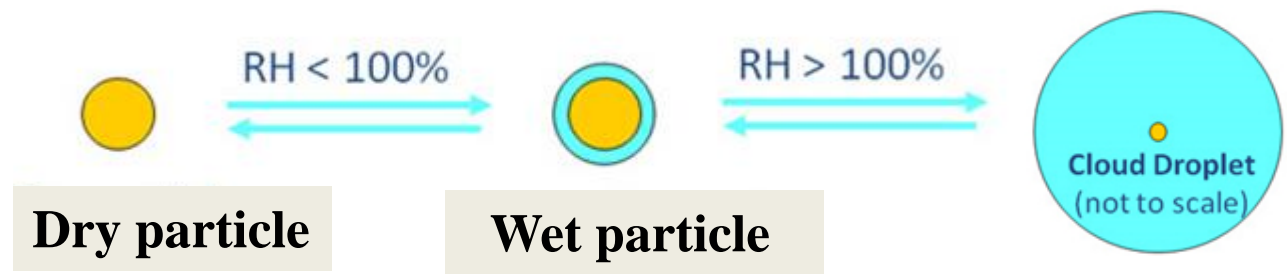


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Research interests

Increasing Relative humidity



Decreasing temperature

Koop, et al., PCCP, 2011



Biomass burning aerosols

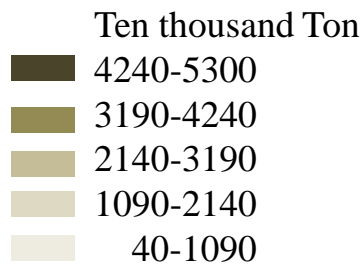
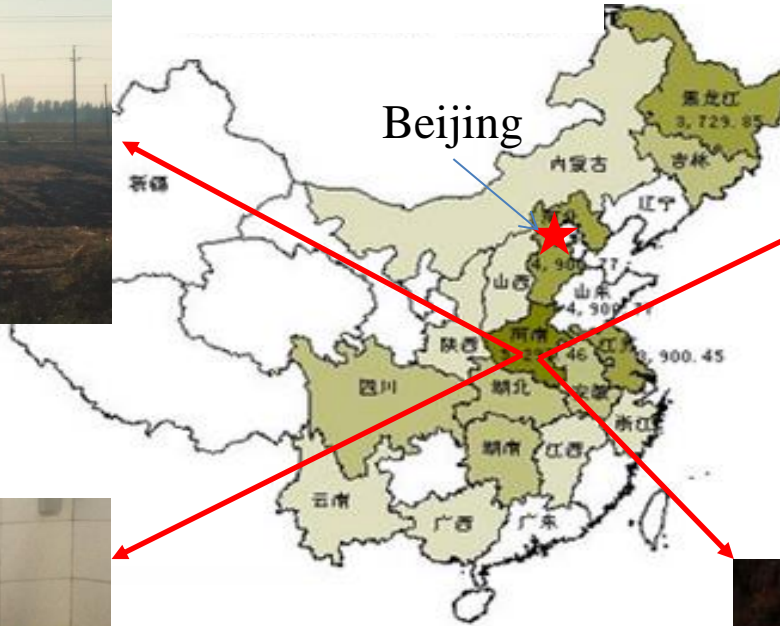
- Globally, open biomass burning emits 2800 Gg yr^{-1} Black Carbon (BC) and contributes one-third of the global BC budget (Bond et al., 2013).
- Biomass burning is also a major source of organic aerosol (OA), contributing two-thirds of the global primary OA budget (Bond et al., 2013).



Very high variability in the optical and CCN activating properties of biomass burning aerosols.



Agricultural waste in China



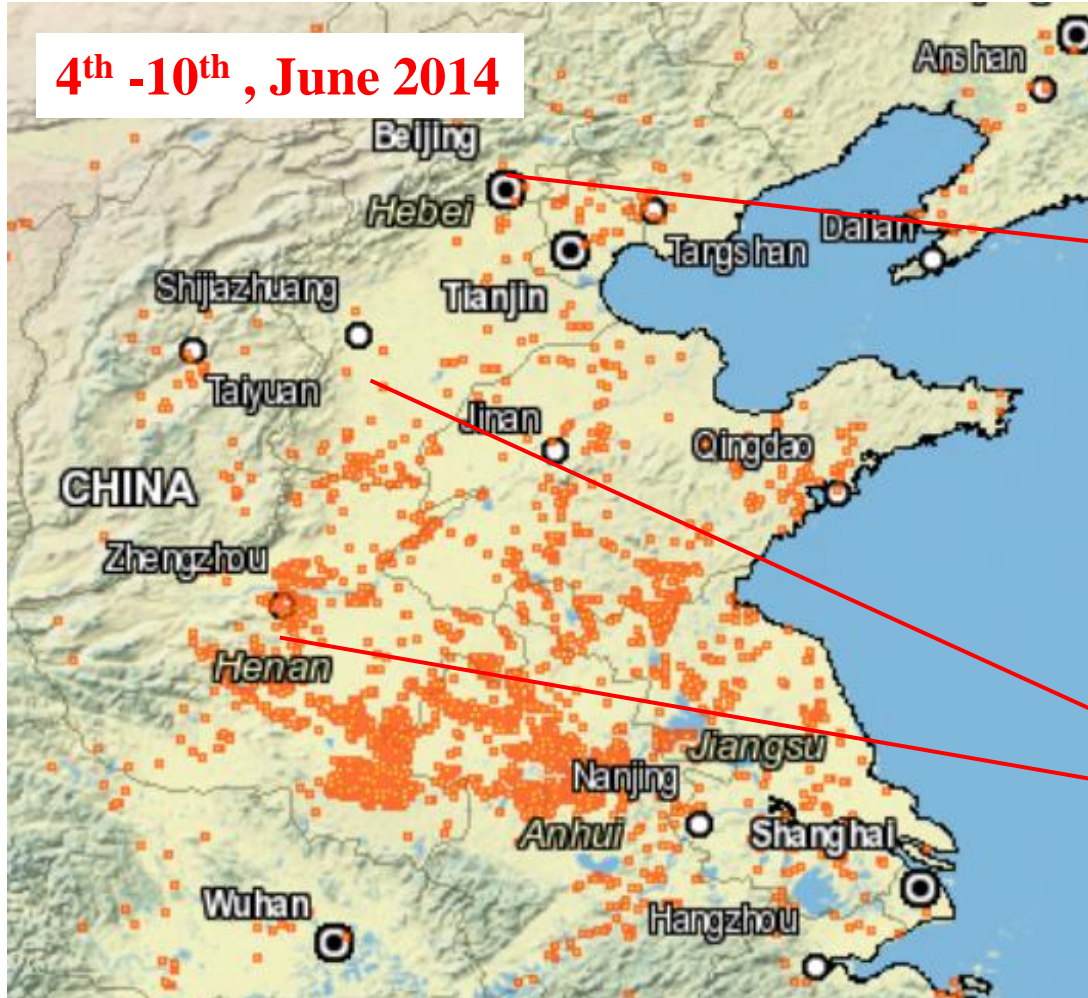
Grain: 0.6 billion Ton in 2015

Waste: 1.2 billion Ton



Wheat straw burning over North China Plain

4th -10th, June 2014



Field observation

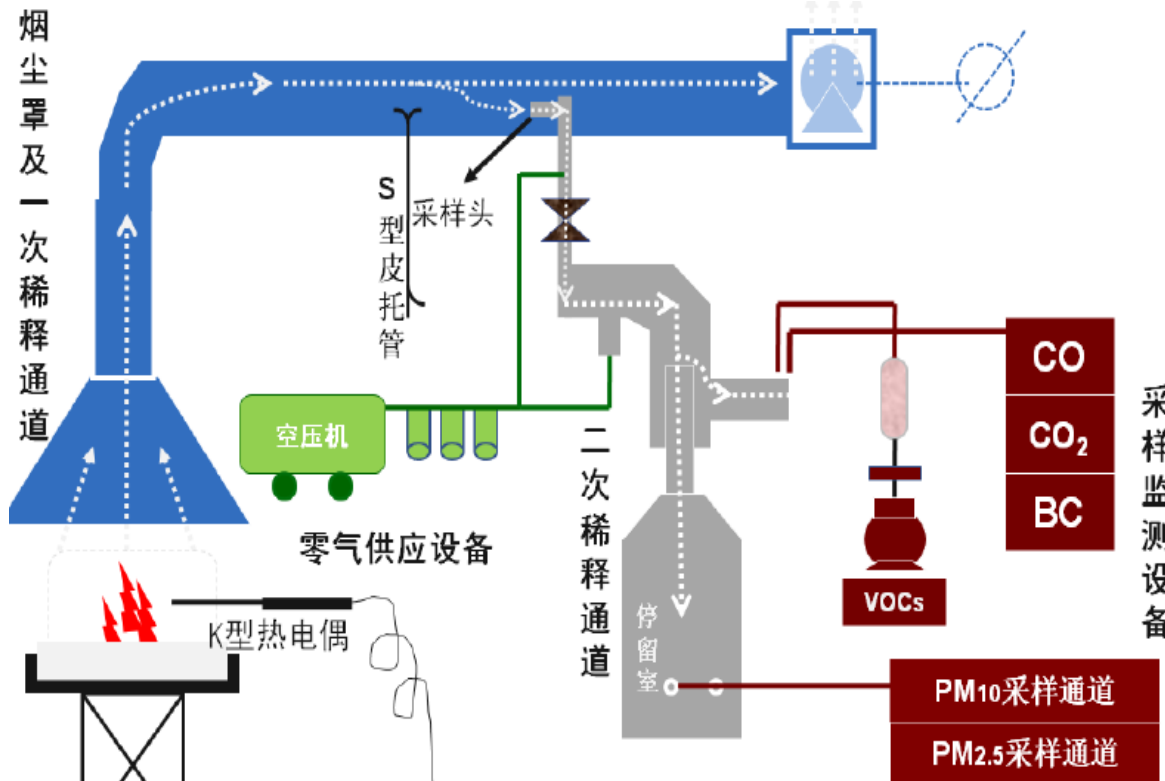


Biomass burning simulation
in the lab



Active fire hotspot detections

Biomass burning simulation



Lower moisture content



Higher moisture content



电子台秤

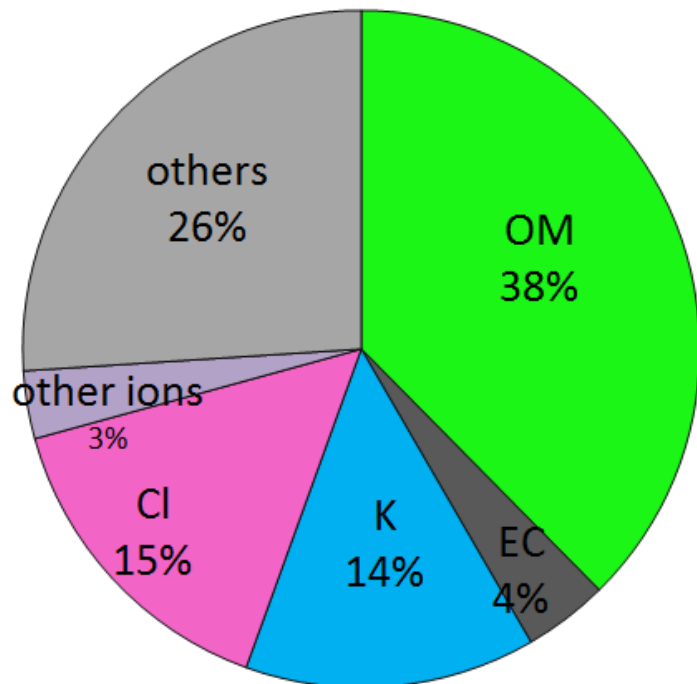


Corn straw burning ↑

← Wheat straw burning

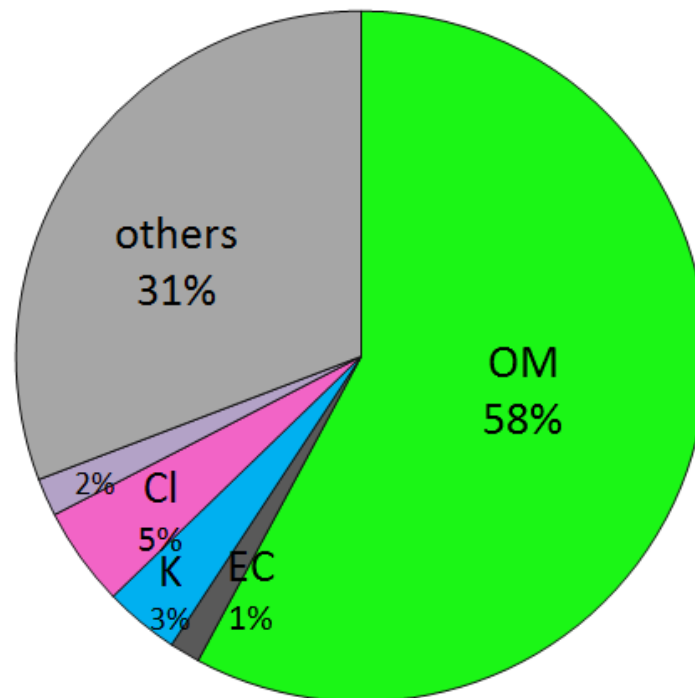
Chemical composition of PM_{2.5}

moisture content 7%



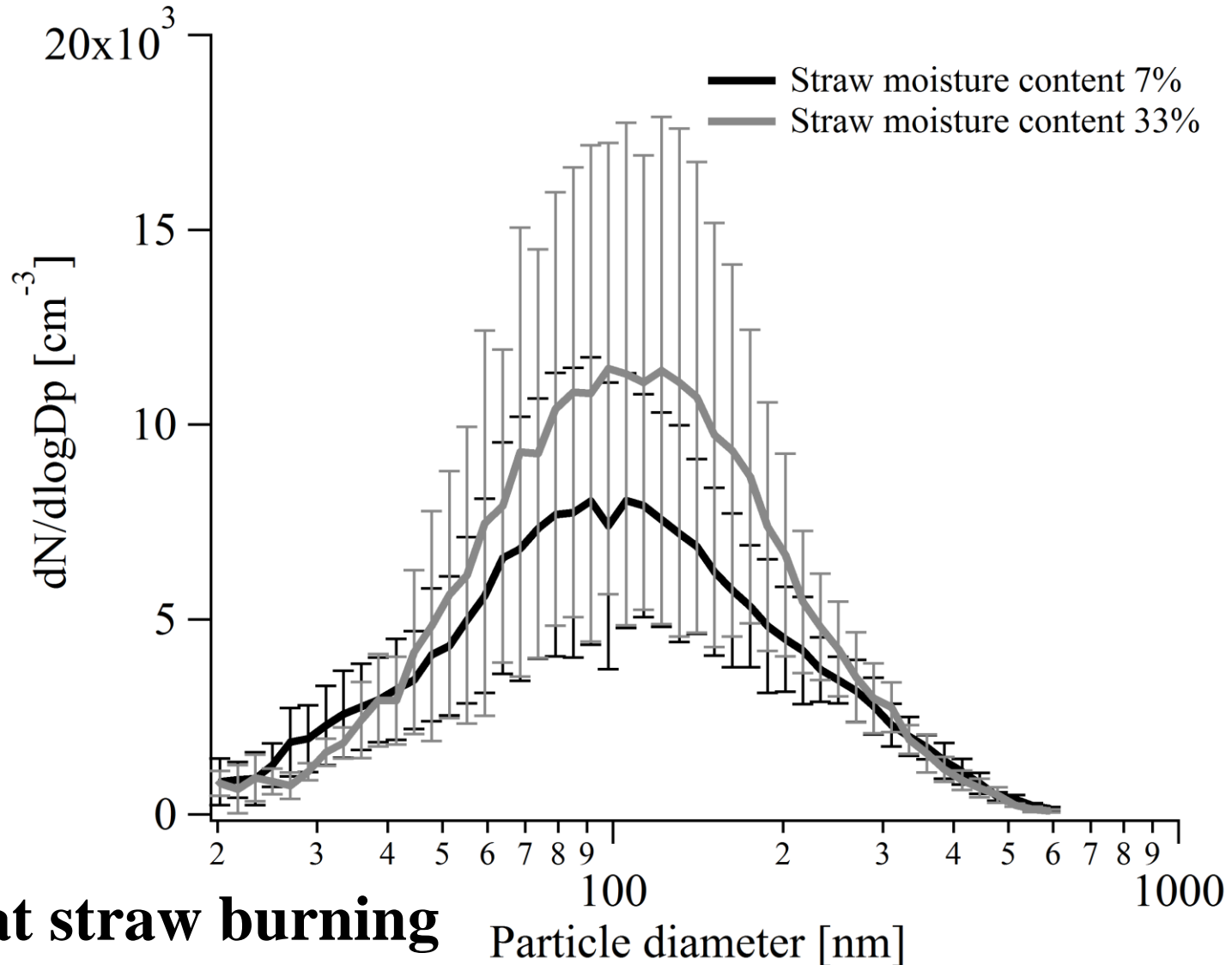
Wheat straw burning

moisture content 33%





Particle number size distribution

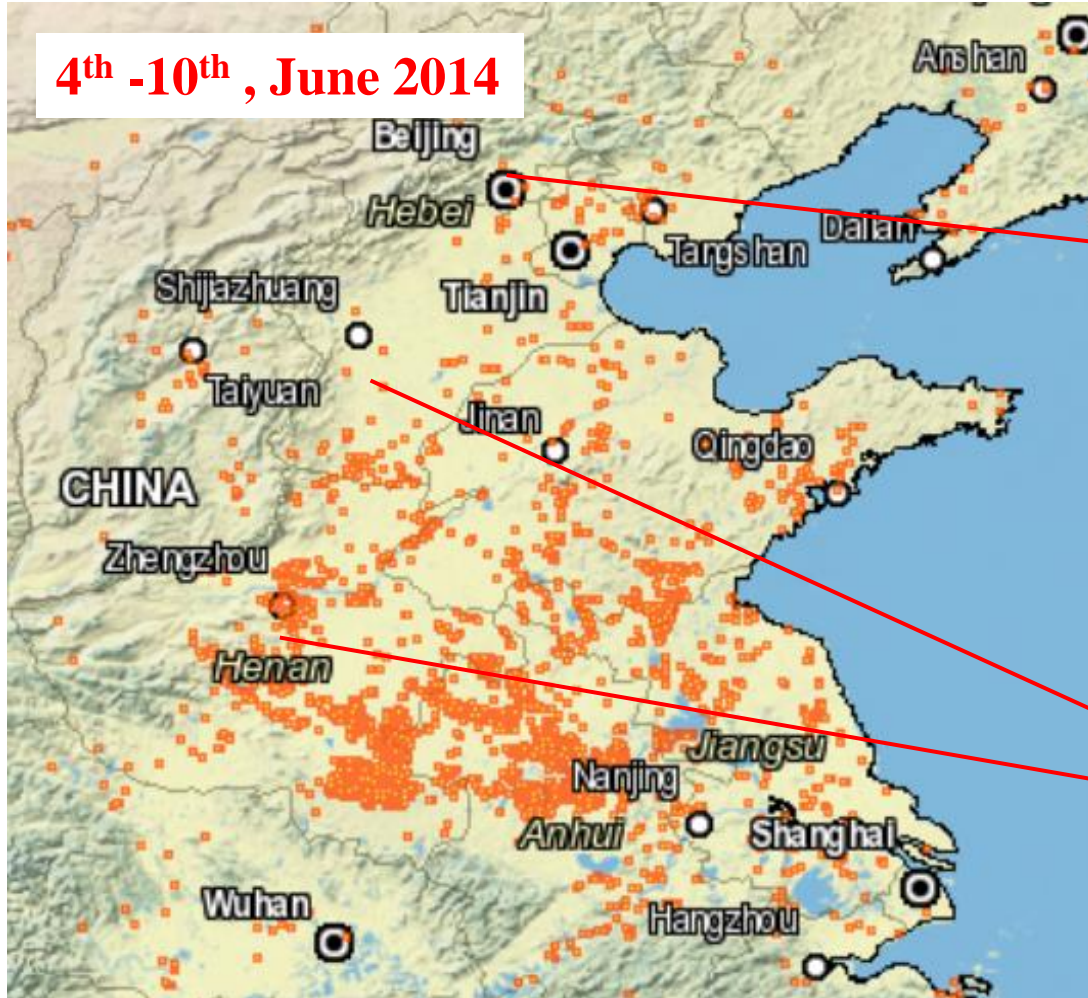


Wheat straw burning



Wheat straw burning over North China Plain

4th -10th, June 2014



Field observation



Biomass burning simulation
in the lab



Active fire hotspot detections



PKU Supersite

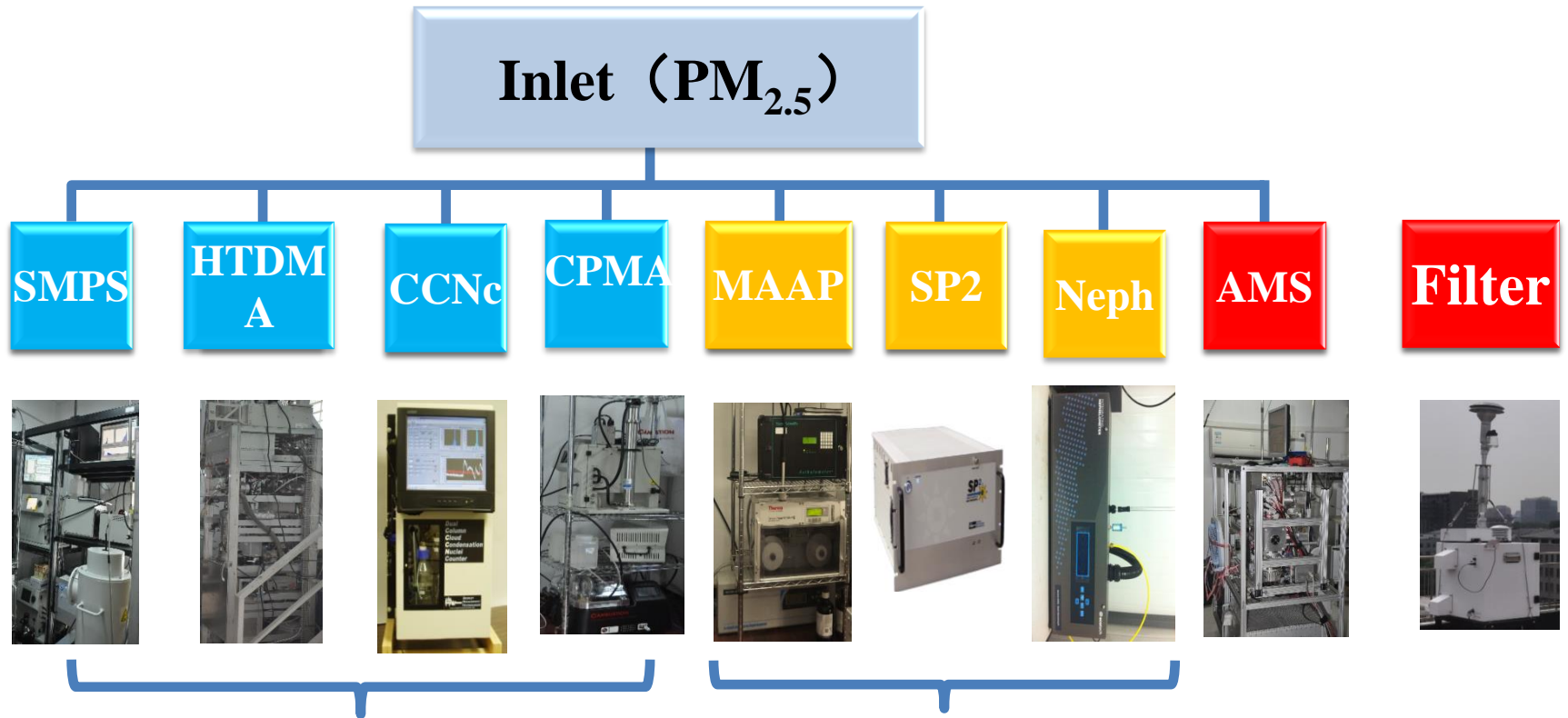


Coefficient	Condition
Temperature	25°C
Flow Rate	16.7 L/min
RH	< 40%
Cut Size	2.5 μm
Drying Methods	Nafion + Compressed dry air



Science Building @ Peking University

Instrumentation



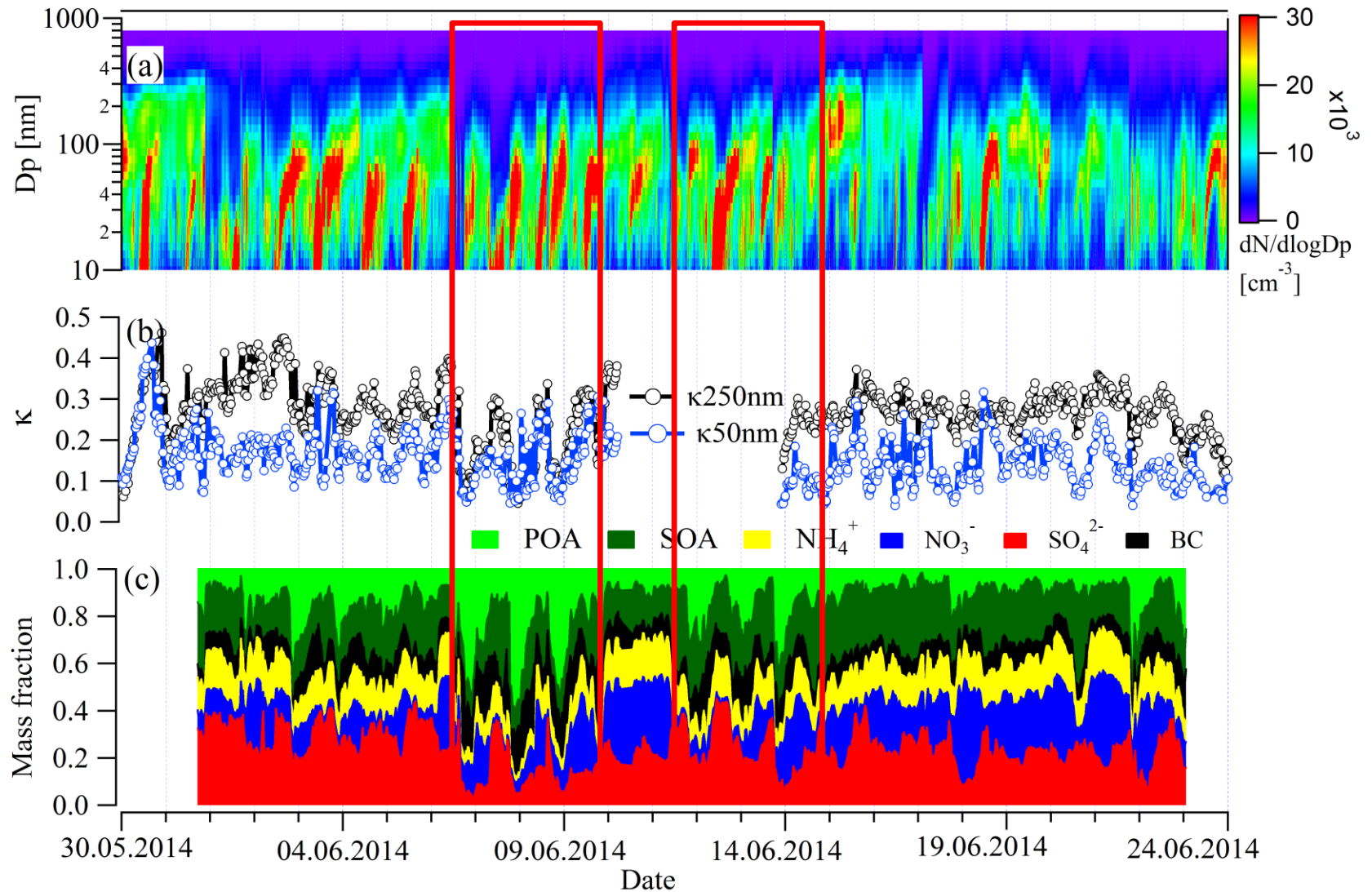
Physical properties

Optical properties

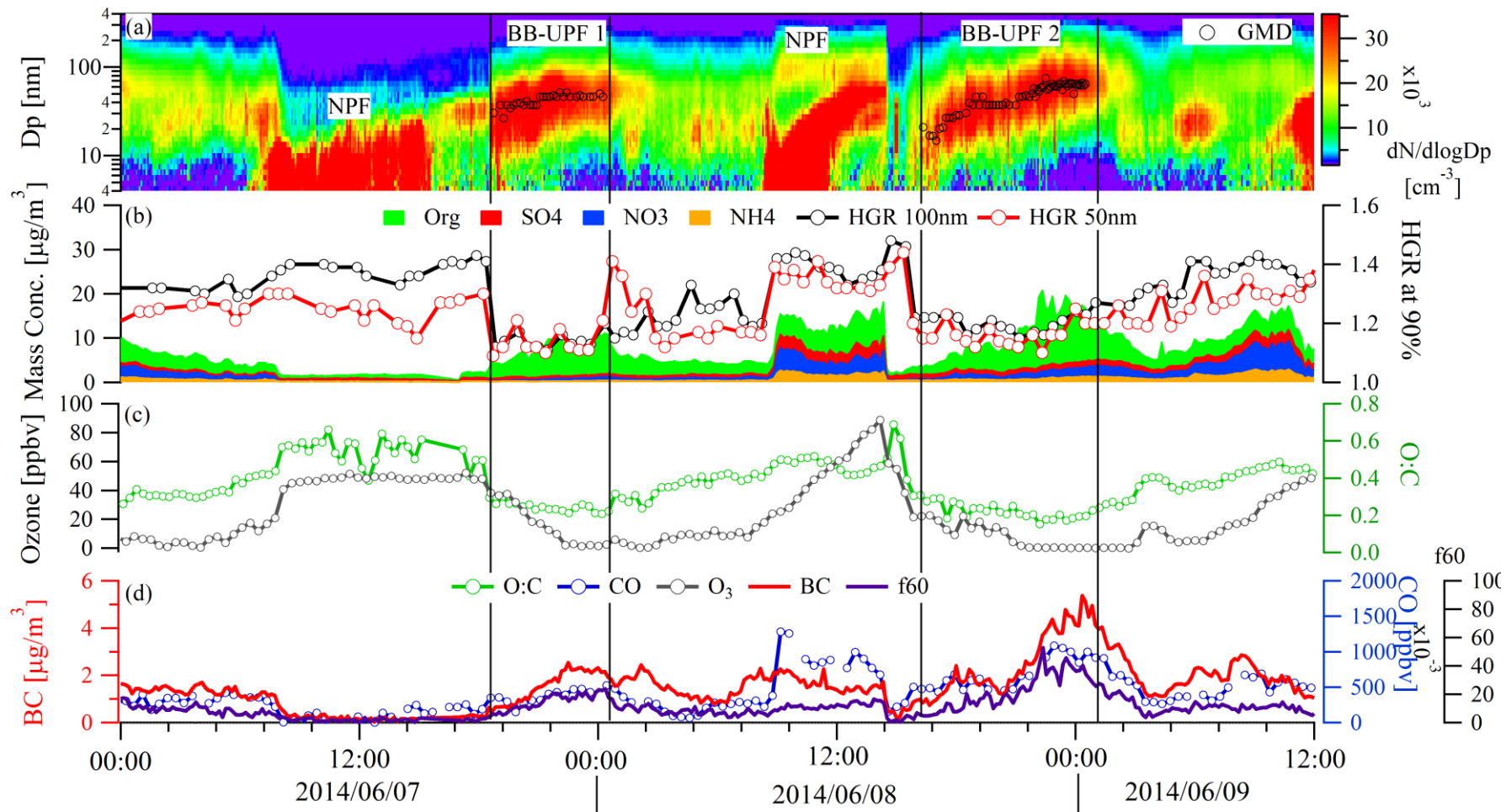
Chemical properties



Chemical and physical properties

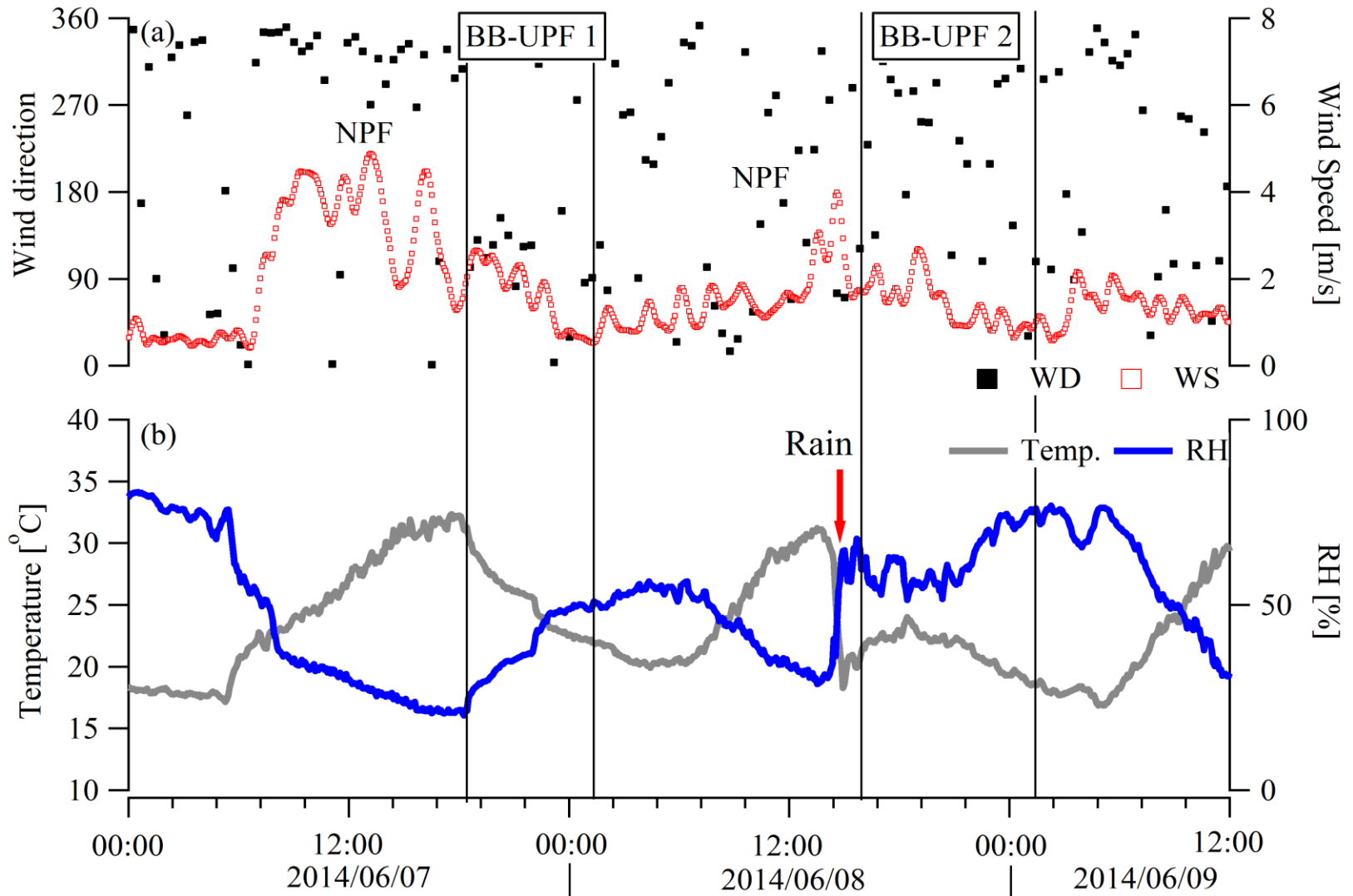


Biomass burning episodes

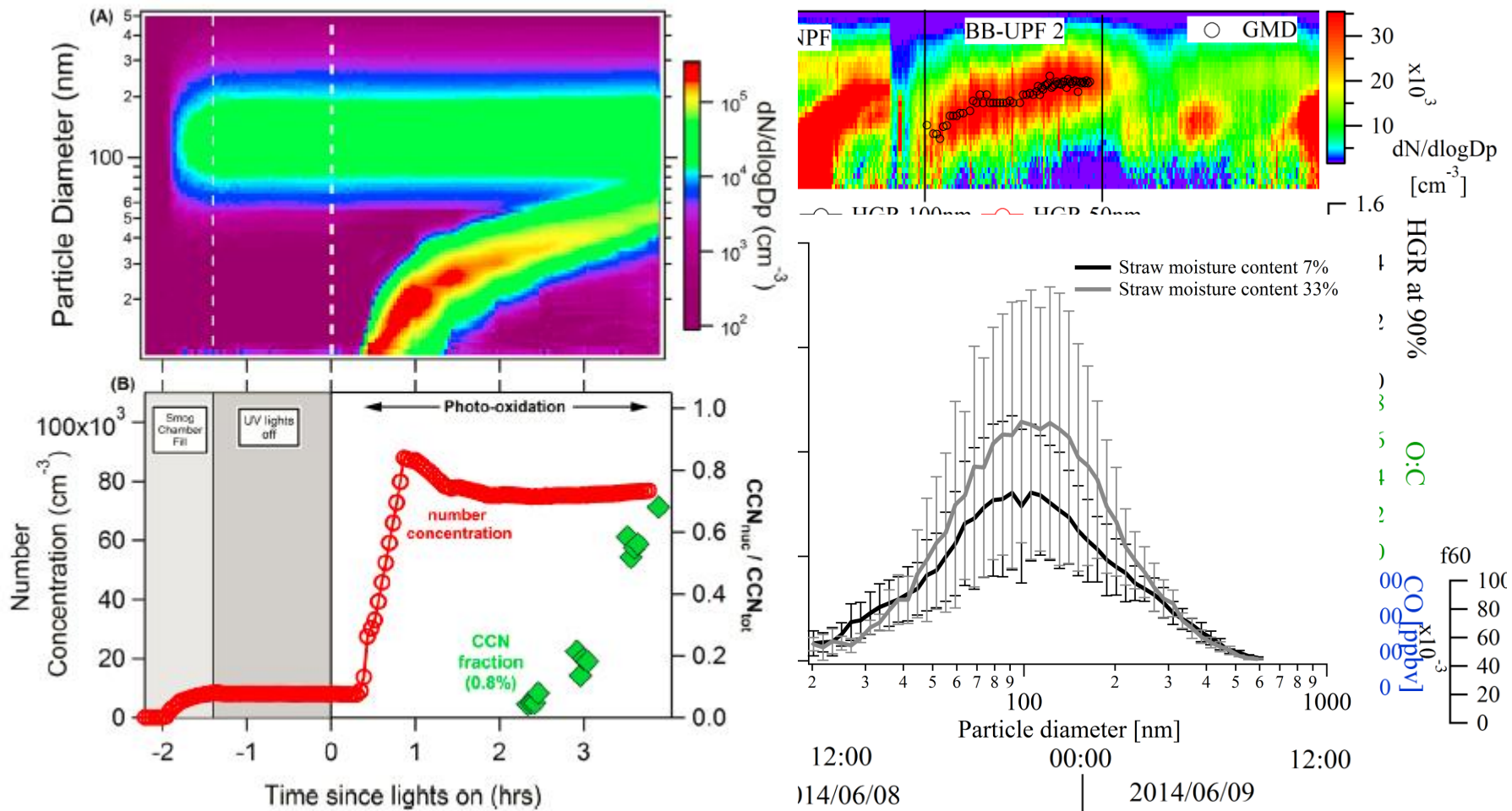




Meteorological parameters

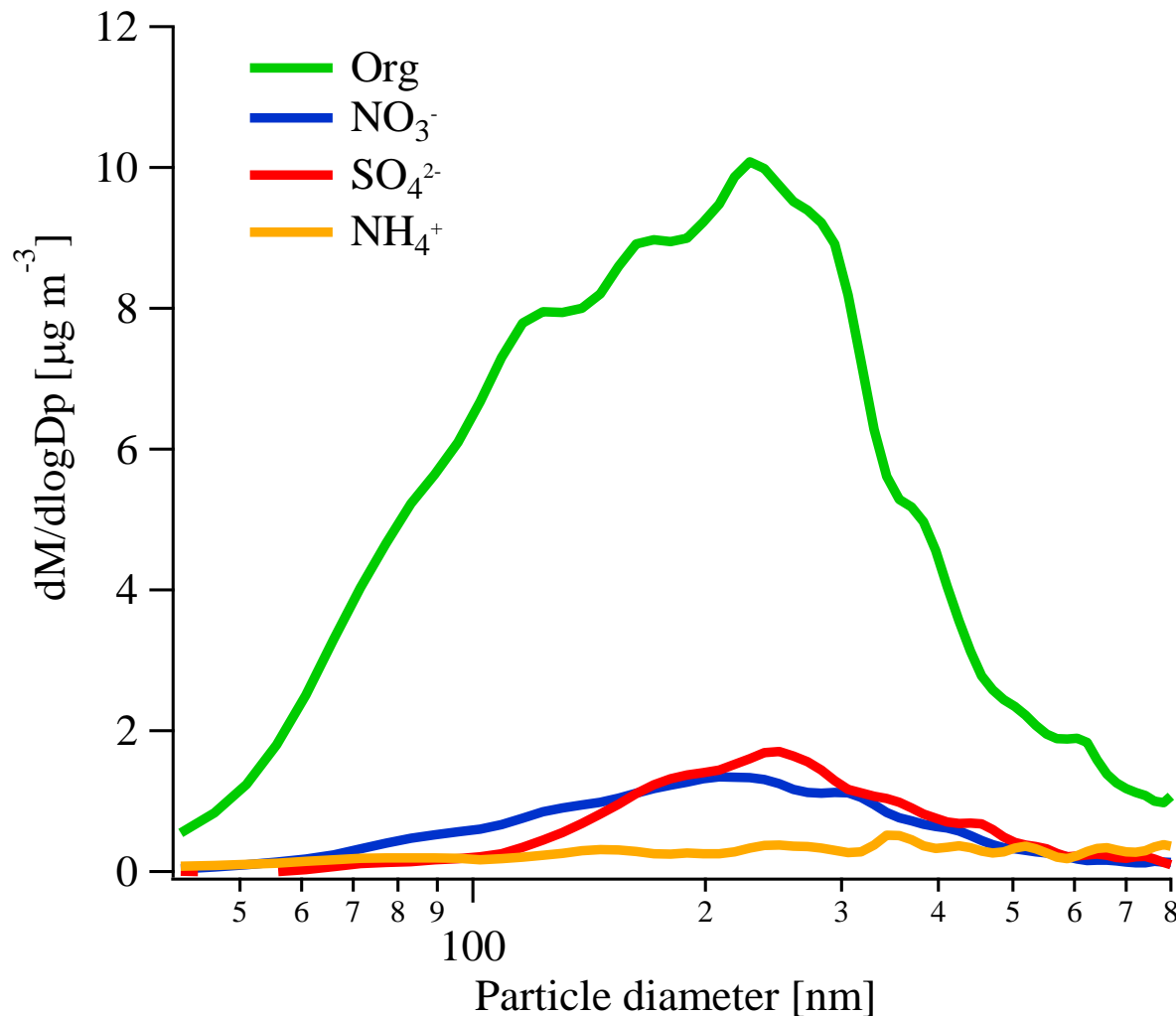


Biomass burning episodes

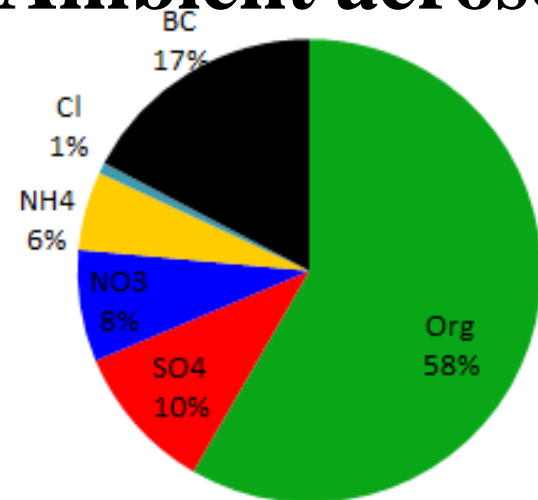


Hennigan, et al., 2012
Growth rate: 3.9 nm/h and 6.5 nm/h

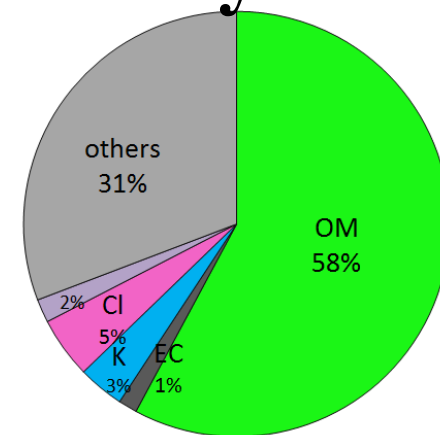
Chemical composition



Ambient aerosol

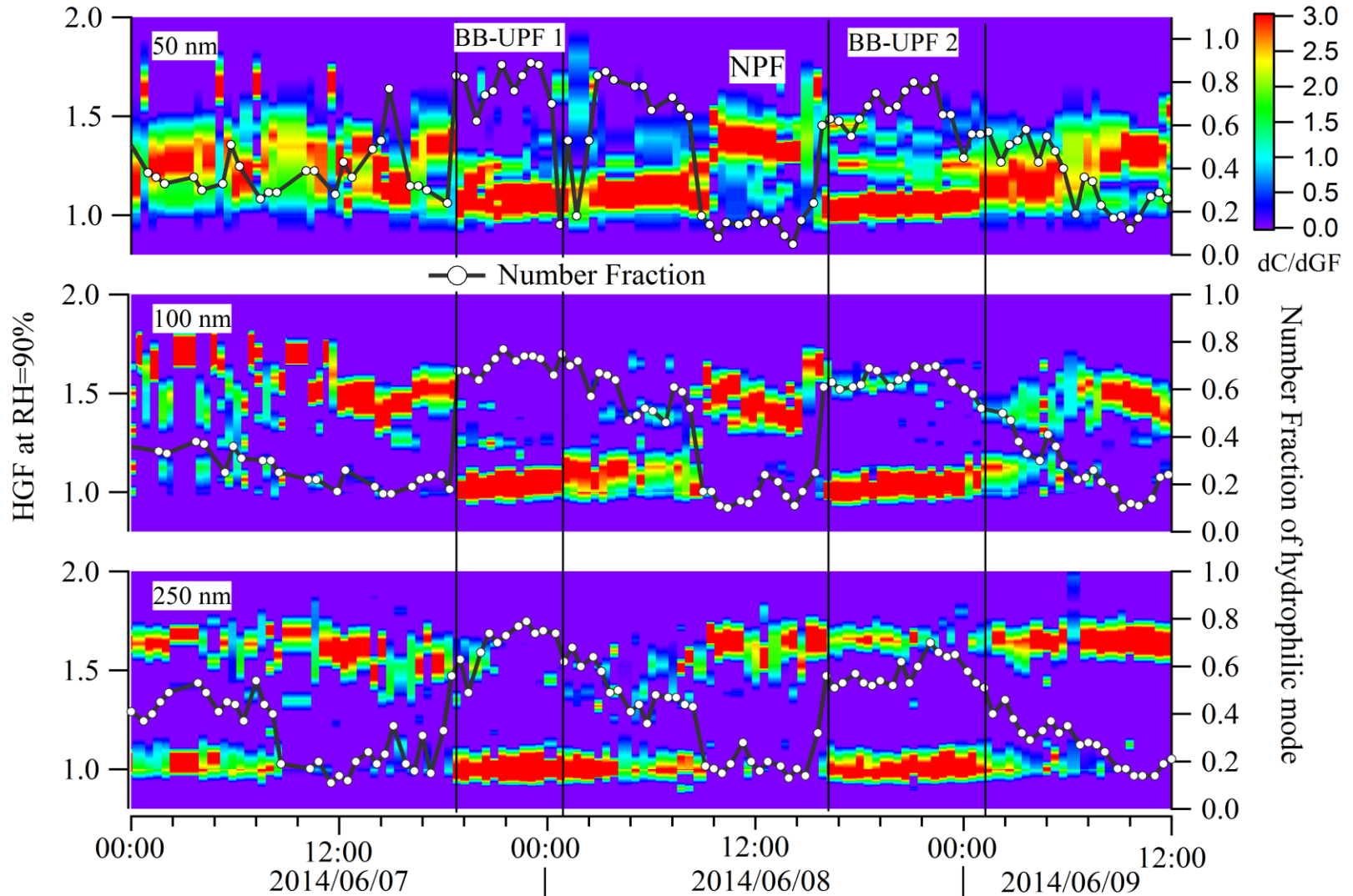


Primary aerosol





Particle hygroscopicity





Particle hygroscopicity

$$\kappa_{HTDMA} = (HGF^3 - 1) \left(\frac{\exp\left(\frac{A}{D_{P,dry} \cdot HGF}\right) - 1}{RH} \right)$$

Dp [nm]	50	100	150	250	350
κ_{HTDMA}	0.08±0.03	0.08±0.02	0.10±0.03	0.10±0.03	0.04±0.02

$$\kappa_{CCN} = \frac{4A^3}{27D_{50}^3 \ln^2 S_c}$$

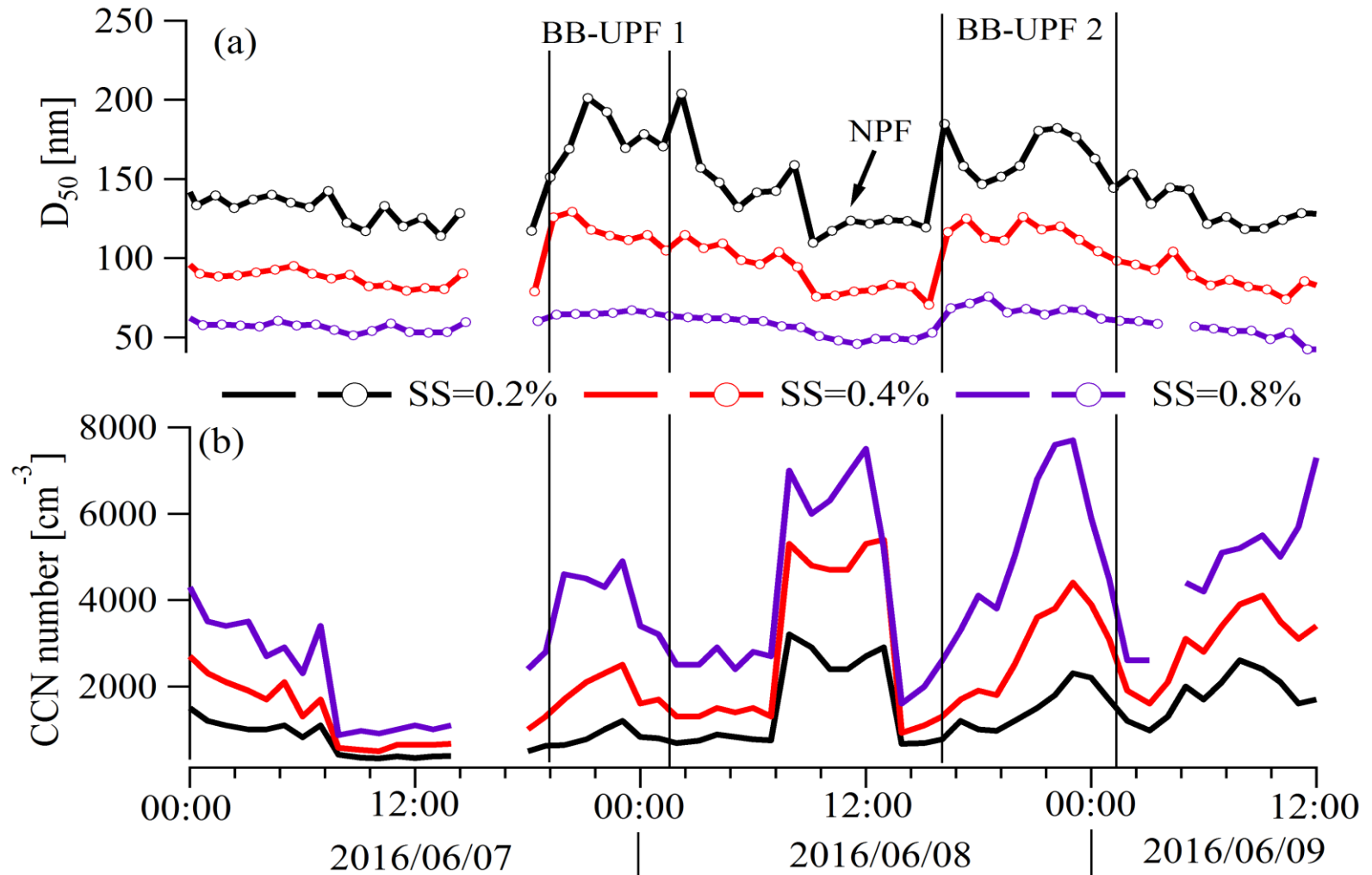
$$A = \frac{4\sigma_s/a M_w}{RT\rho_w}$$

Sc	0.2%	0.4%	0.8%
D50	171 ± 16 nm	118 ± 6 nm	67 ± 3 nm
κ_{CCN}	0.09 ± 0.03	0.06 ± 0.01	0.09 ± 0.01

κ_{CCN} : 0.02-0.8 Petters et al. (2009)



CCN number concentration





Summary

- The burst and growth of ultrafine particles was observed during the biomass burning episode.
- The organics and BC account for $60 \pm 10\%$ and $18 \pm 3\%$ of PM₁.
- These ultrafine particles were less CCN active.



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