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Black Carbon and Coating Measurements at Pasadena

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Greg Kok (Droplet Measurement Technologies)

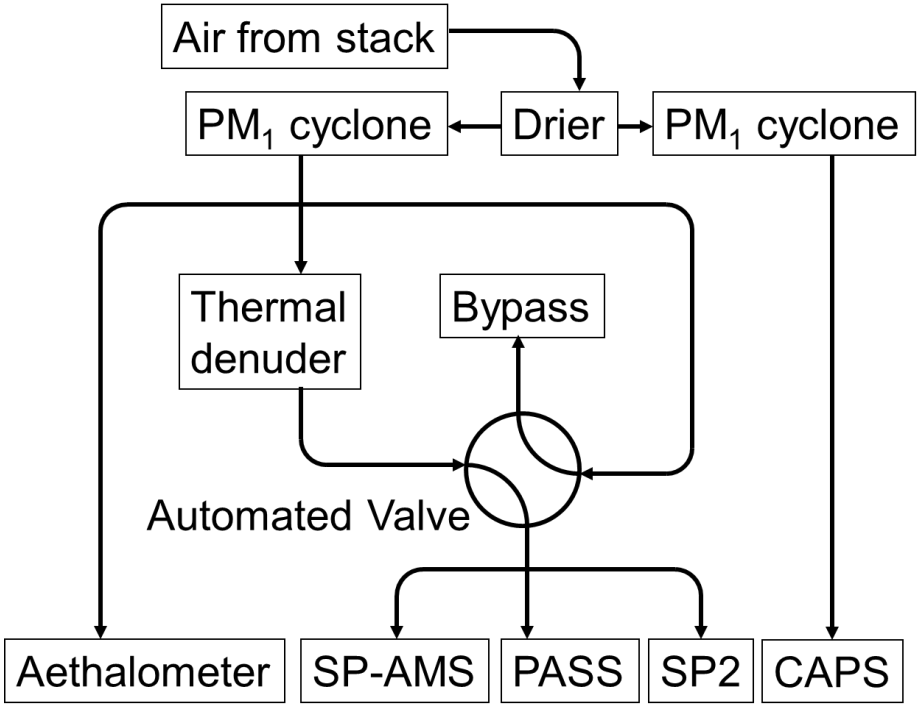
CALNEX
LOS ANGELES

DROPLET MEASUREMENT TECHNOLOGIES

Motivation

- Black Carbon (BC) is a major climate forcing component, particular on regional scales
- Its lifetime and optical properties are heavily dependent on composition and coatings
- BC is also seen as an important air quality metric and is measured using filter-based optical methods
- There is a need to quantitatively link composition and coatings with source, atmospheric ageing, optical properties and network metrics

Overall set-up



Aethalometer

- Magee AE-31 7-wavelength Aethalometer
- Filter loading correction applied based on SP2 data
- No scattering correction applied
- Data reported as µg m^{-3} equivalent black carbon, using the manufacturer's calibration

PASS

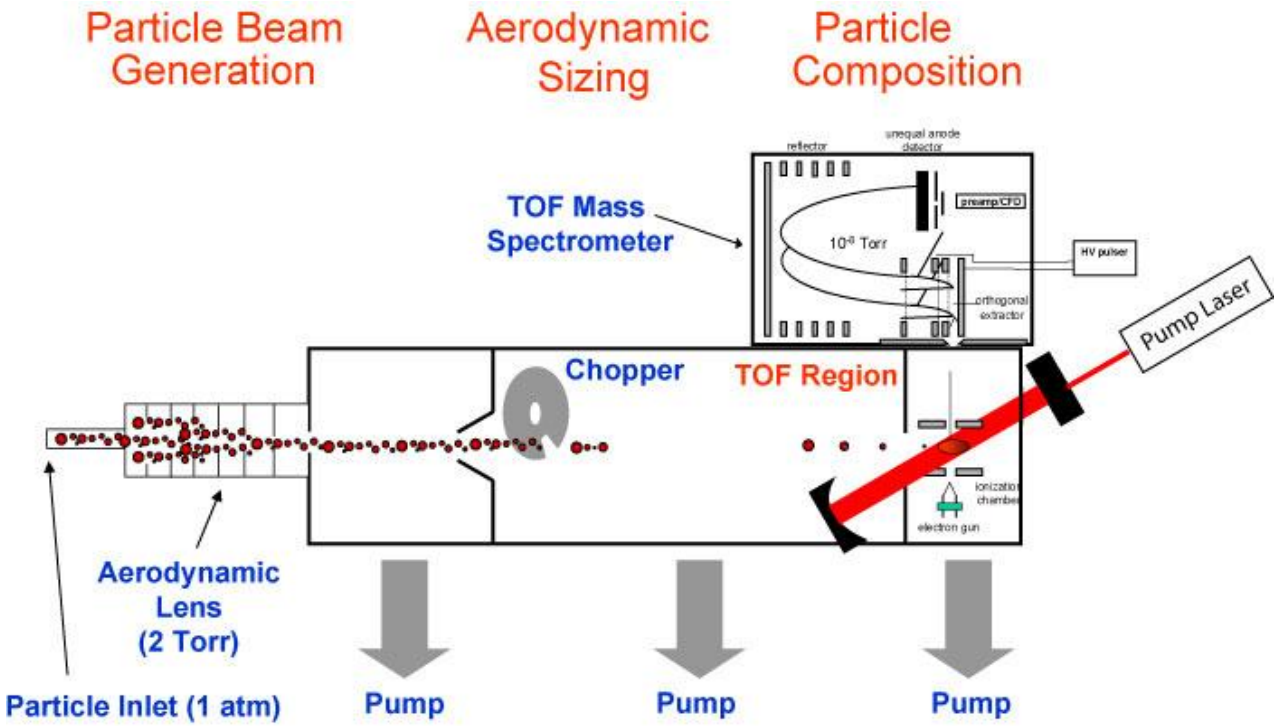
- 3 wavelength DMT photoacoustic spectrometer
- Green channel calibrated using absorbing PSLs compared with SP2 scattering channel
- Red and blue channels calibrated relative to green using fullerene soot and assuming an AAE of 1

SP-2

- Calibrated using glassy carbon spheres selected using a DMA
- Primary data products are black carbon mass and number concentrations
- Higher-order data products will include mass corrected for detection limit cutoff and coating thicknesses

SP-AMS

- Cross calibrated against SP2 using glassy carbon
- Size calibrated using absorbing PSLs



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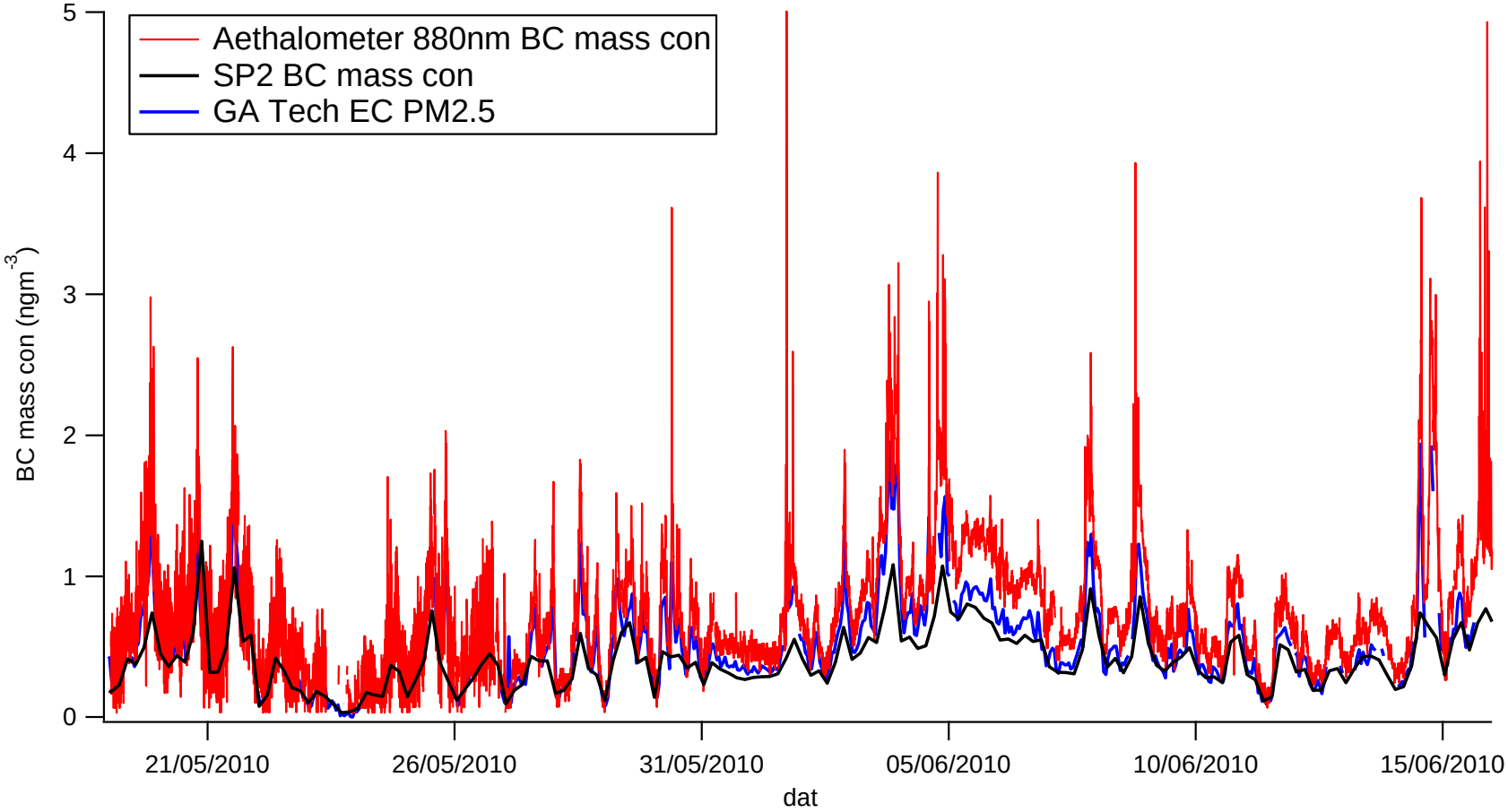
SP2 vs aeth & EC



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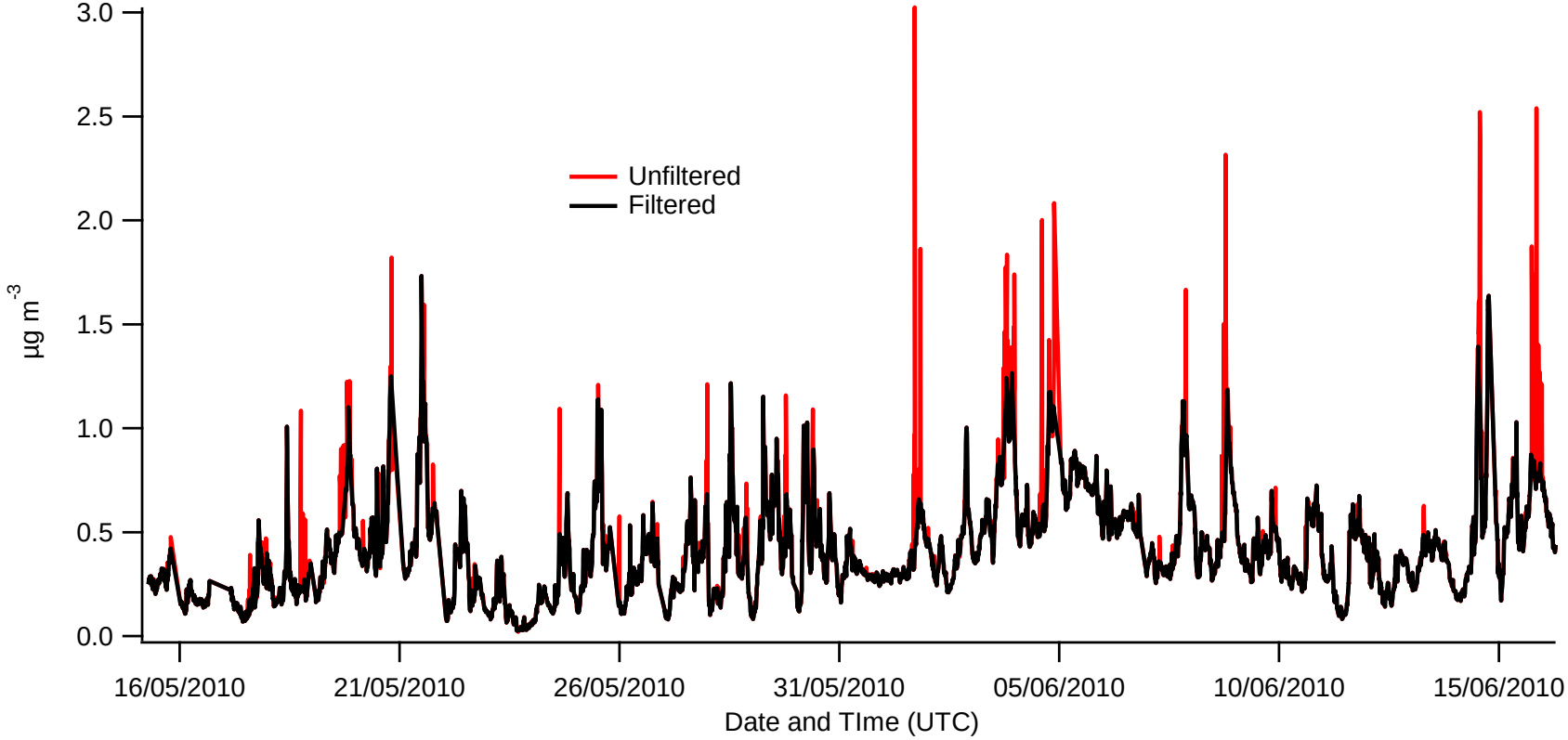
Forklift influence



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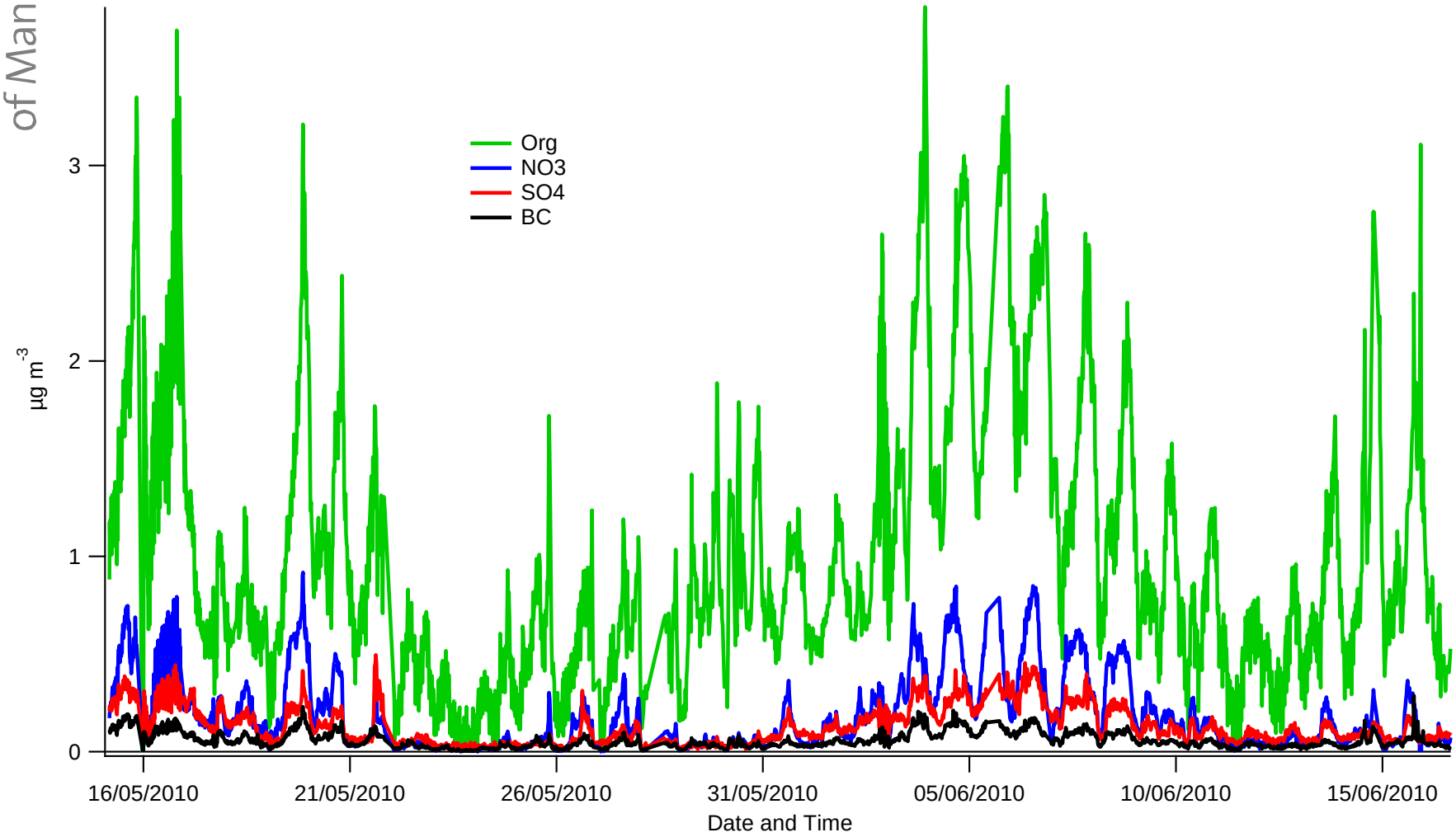
SP-AMS results



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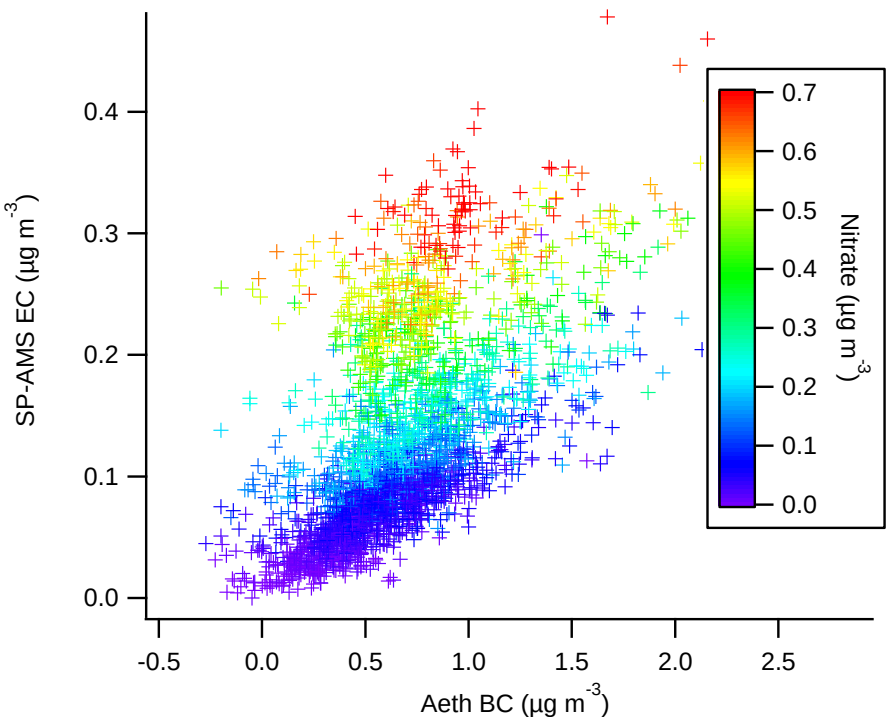
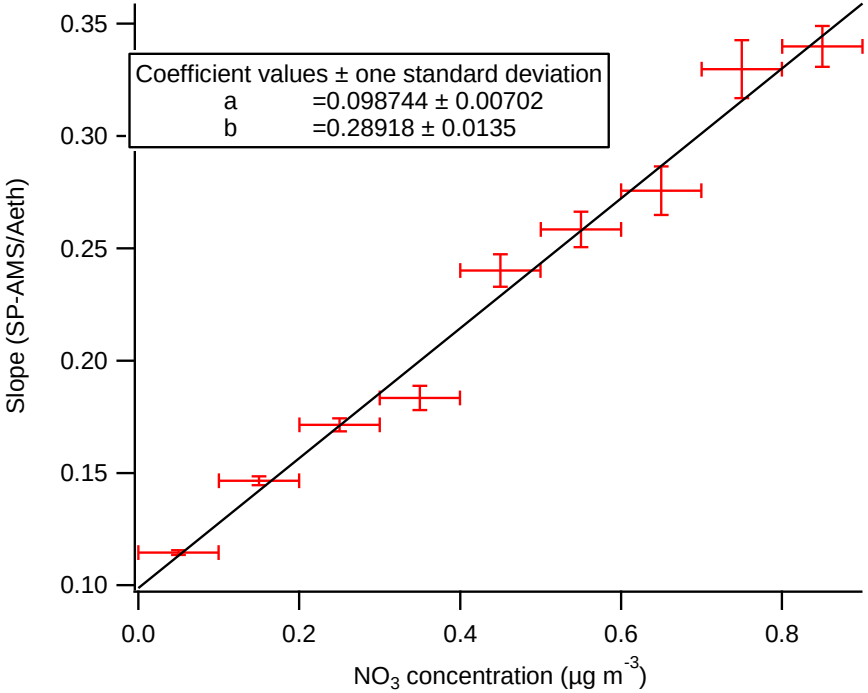
Particle transmission modification?





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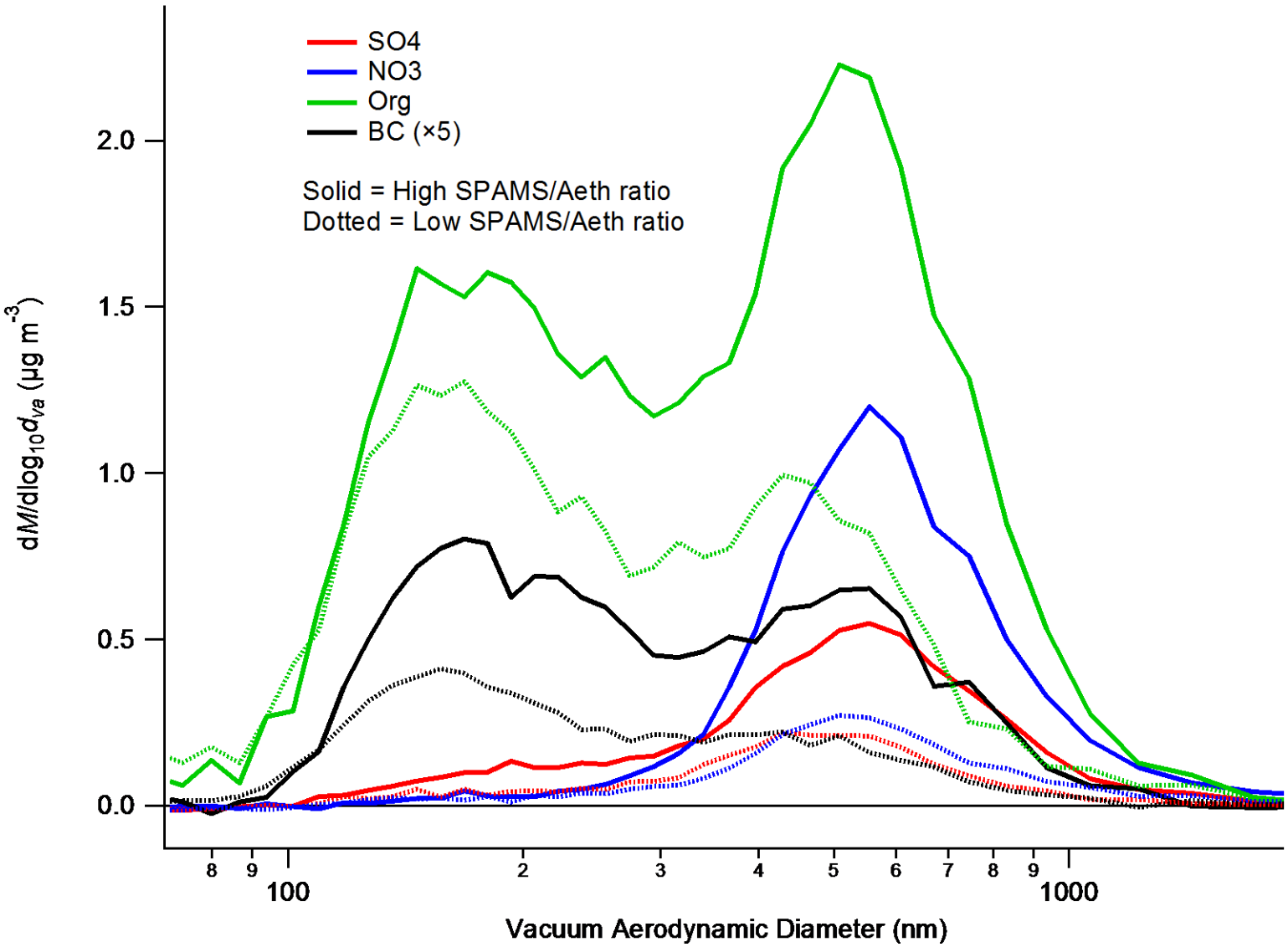

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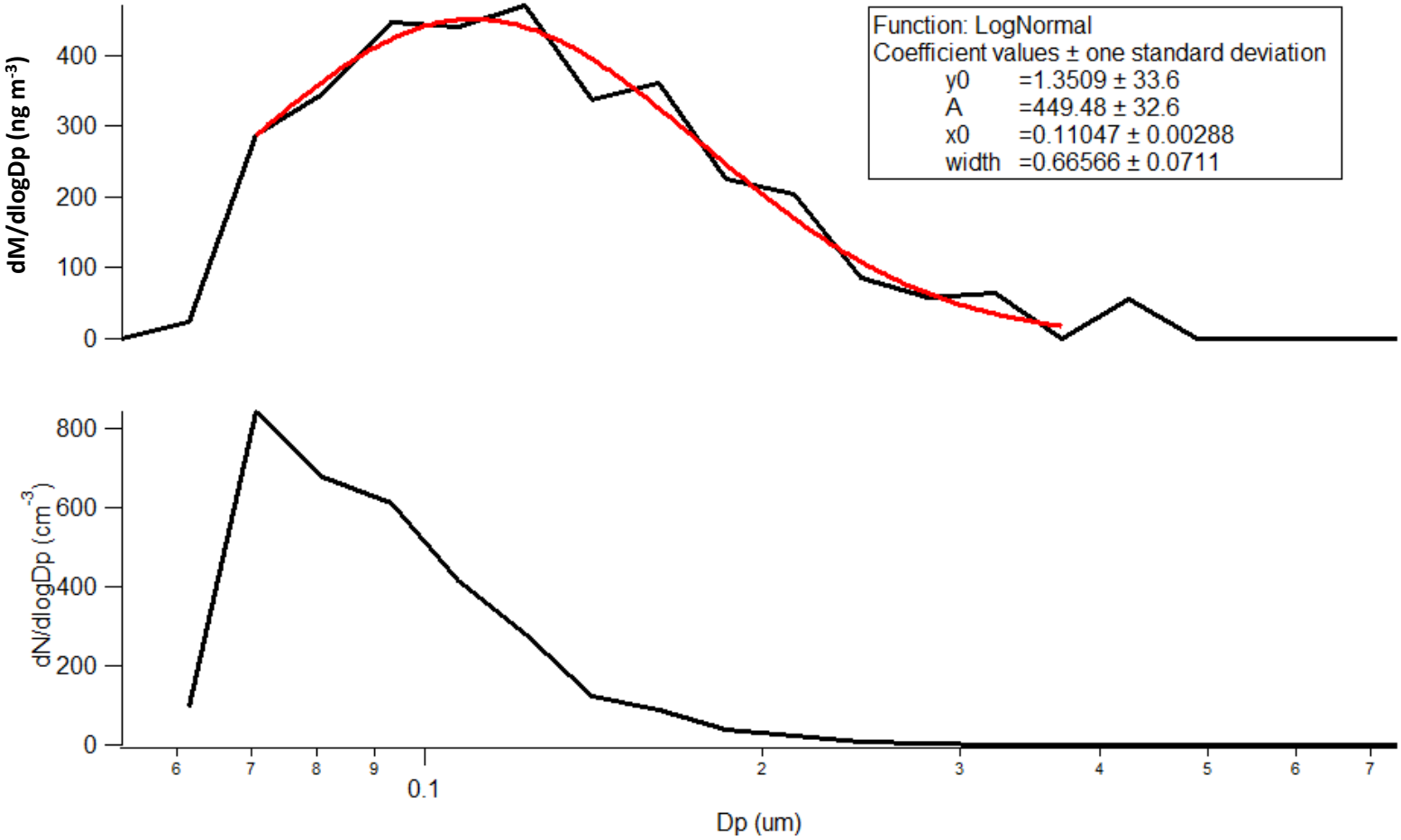
SP2 size distribution



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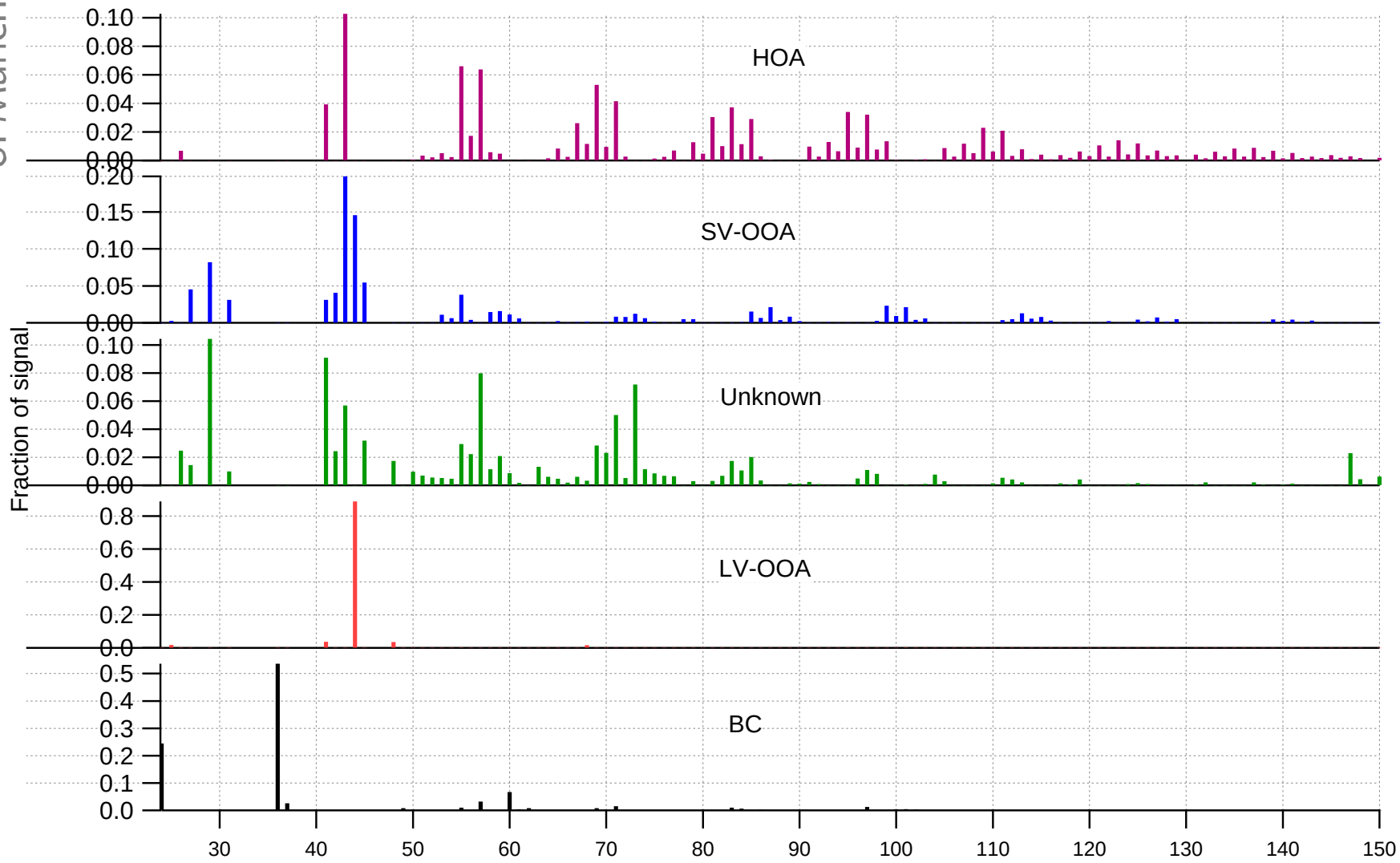
PMF analysis



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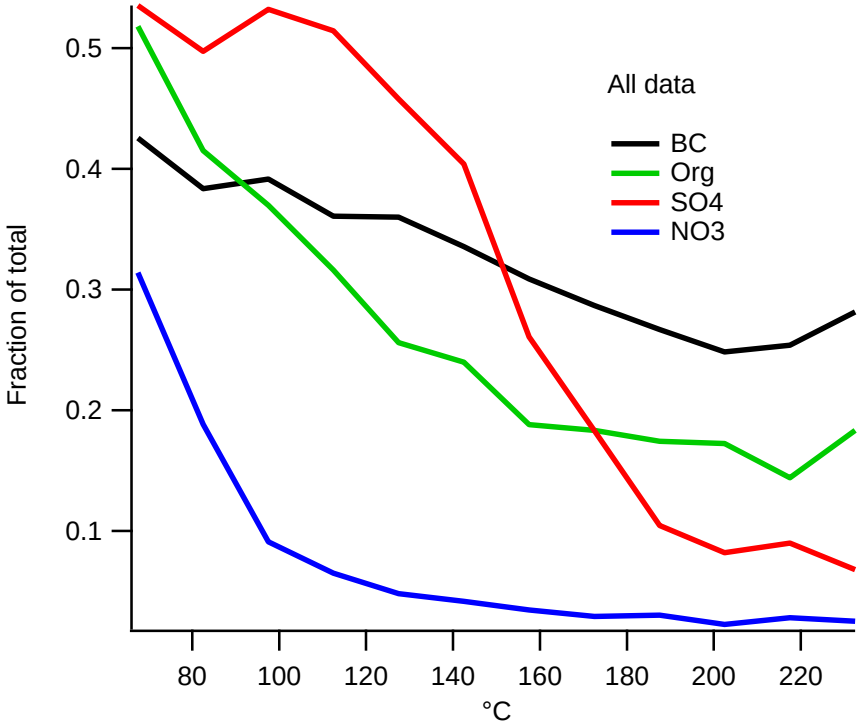
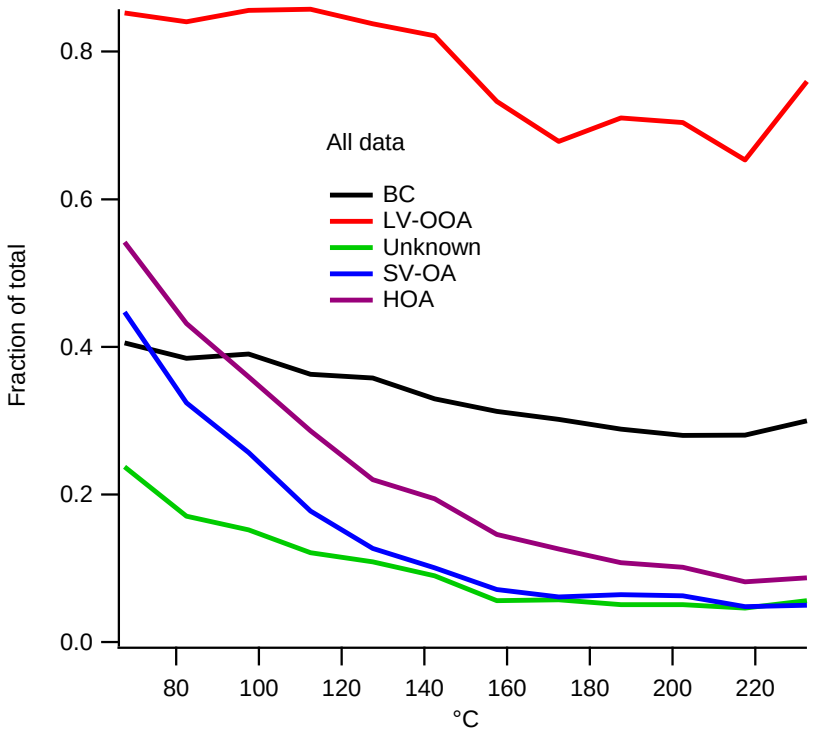
Thermograms





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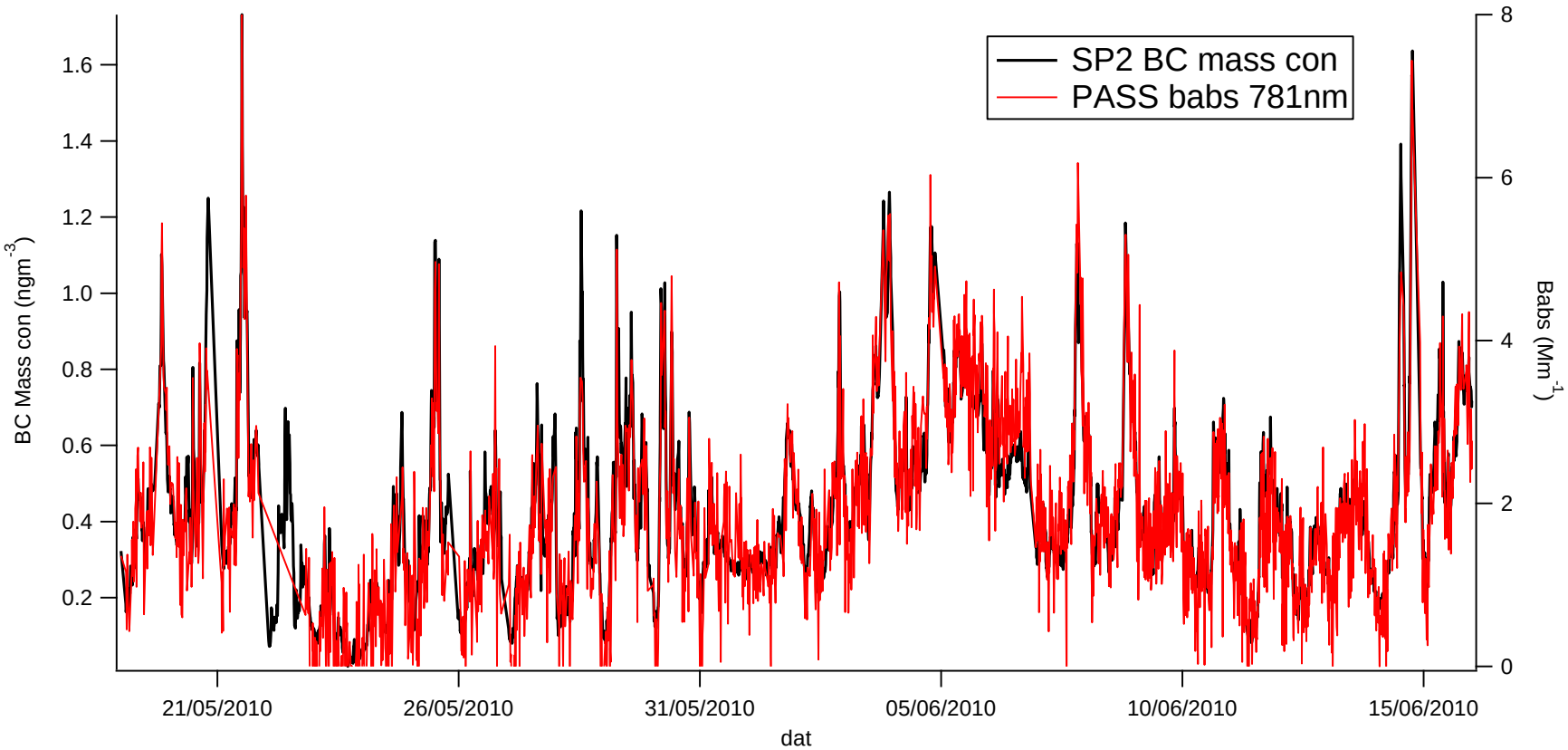
SP2 vs PASS



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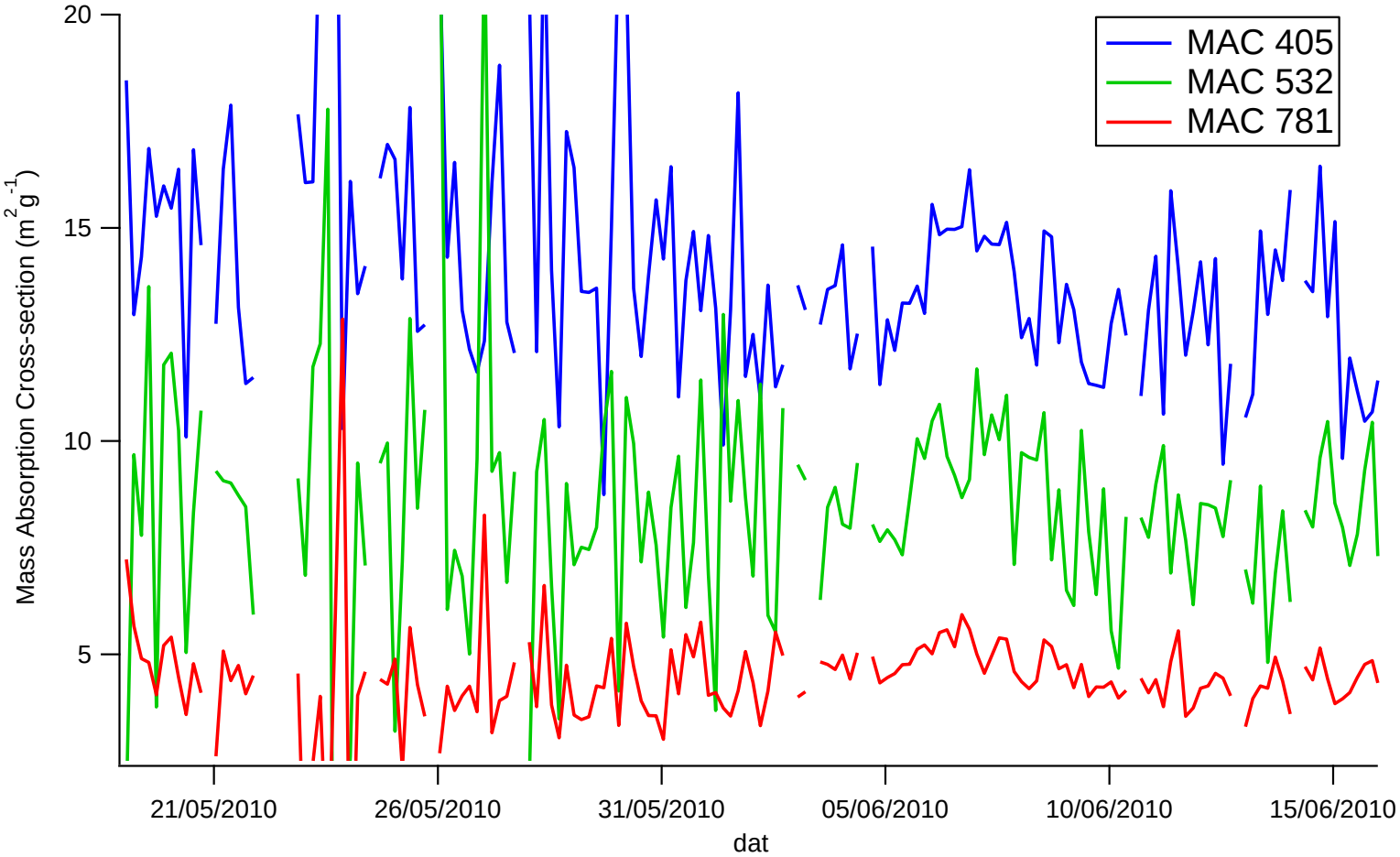
Ambient MAC



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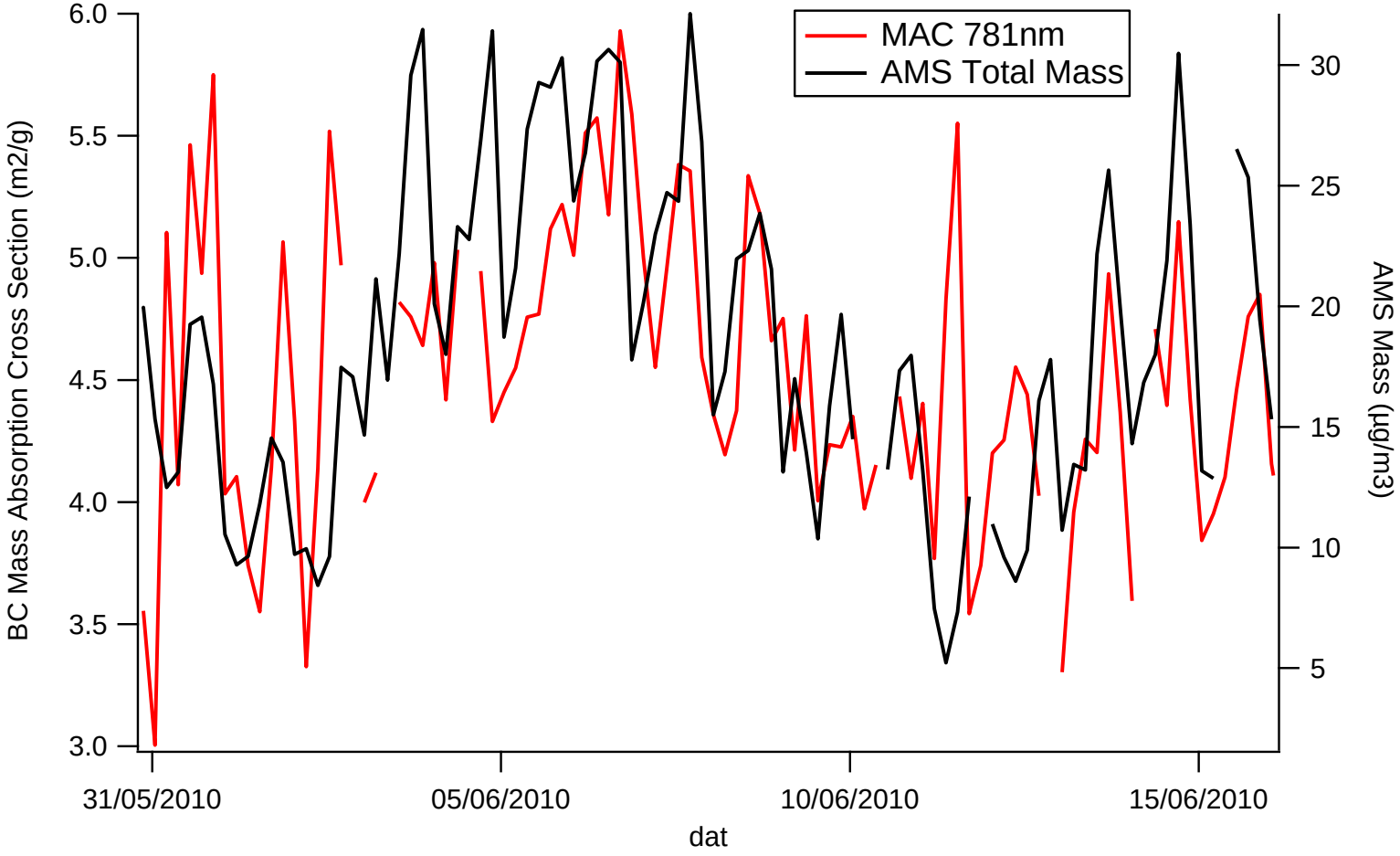

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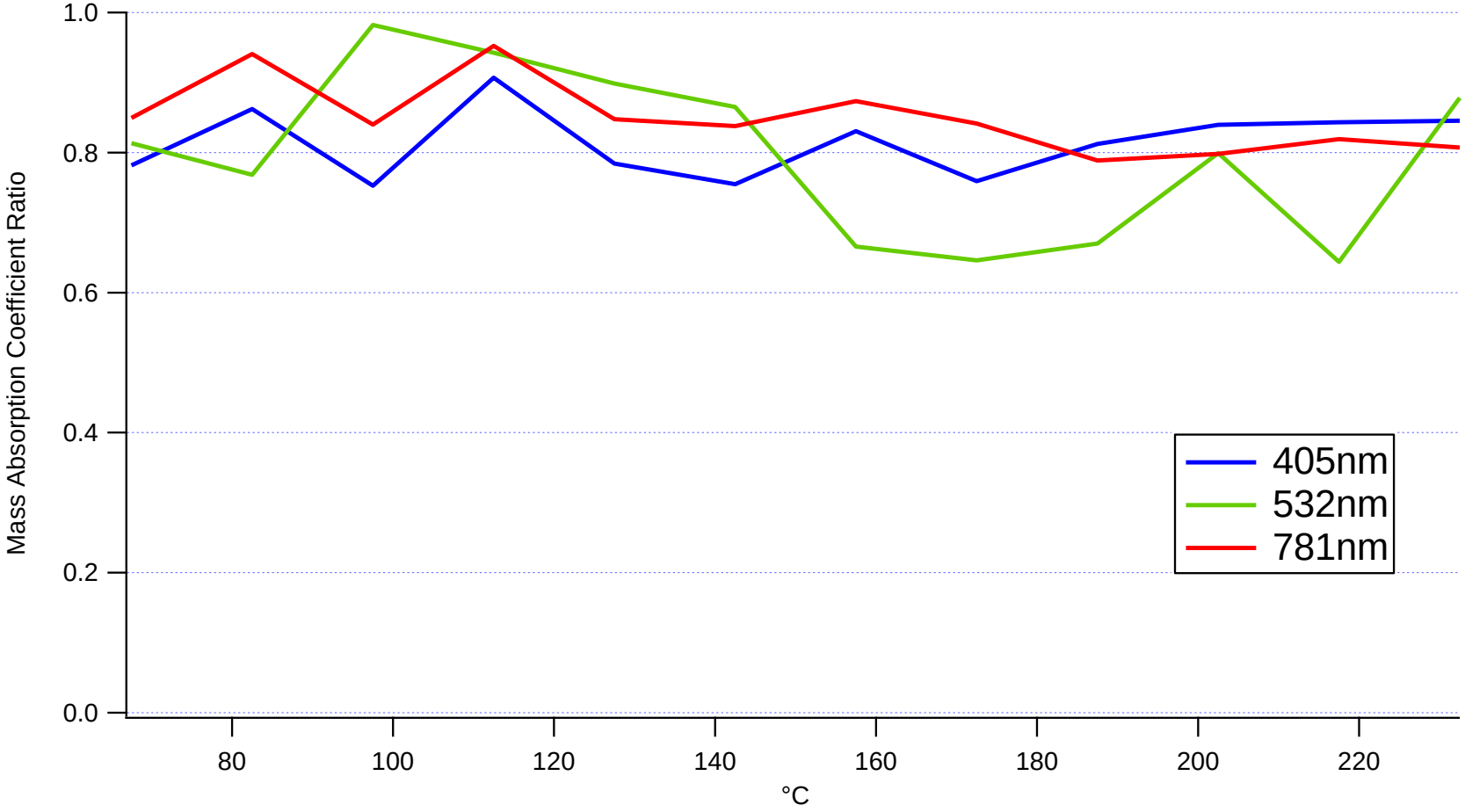
Denuder MAC 3-9 June



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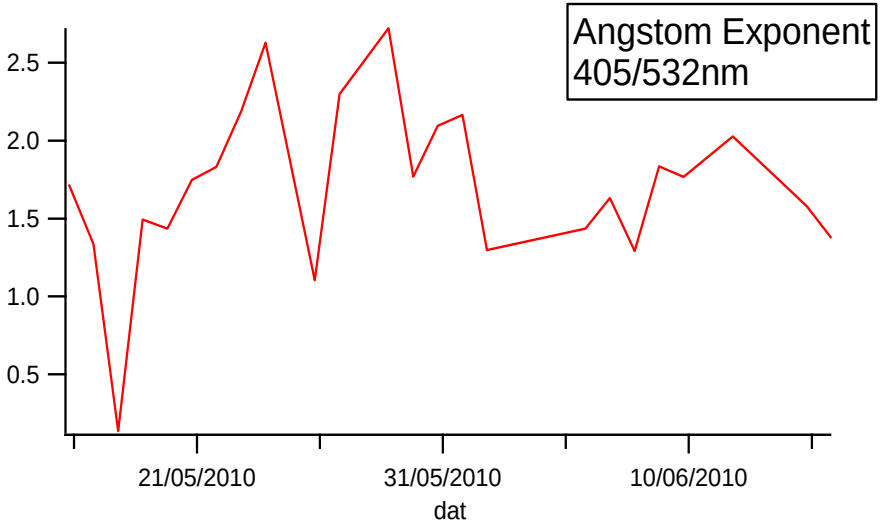
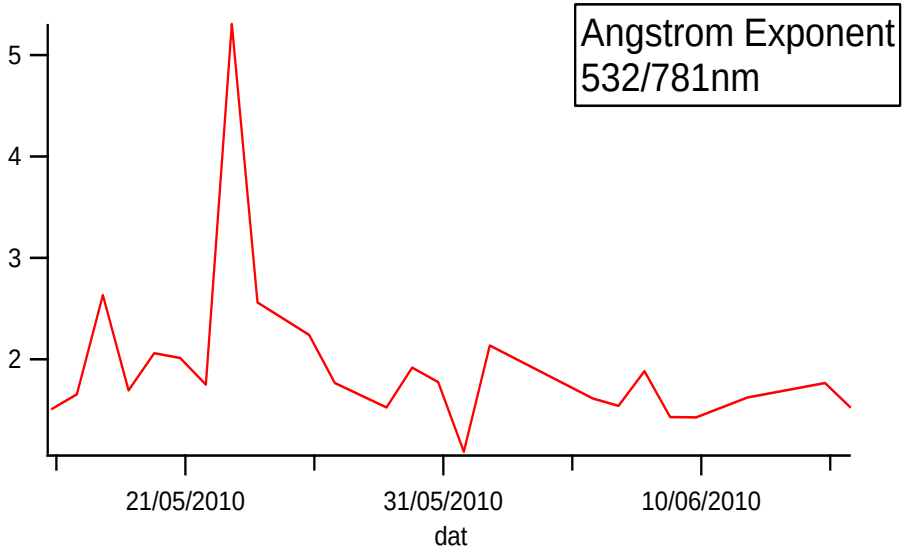
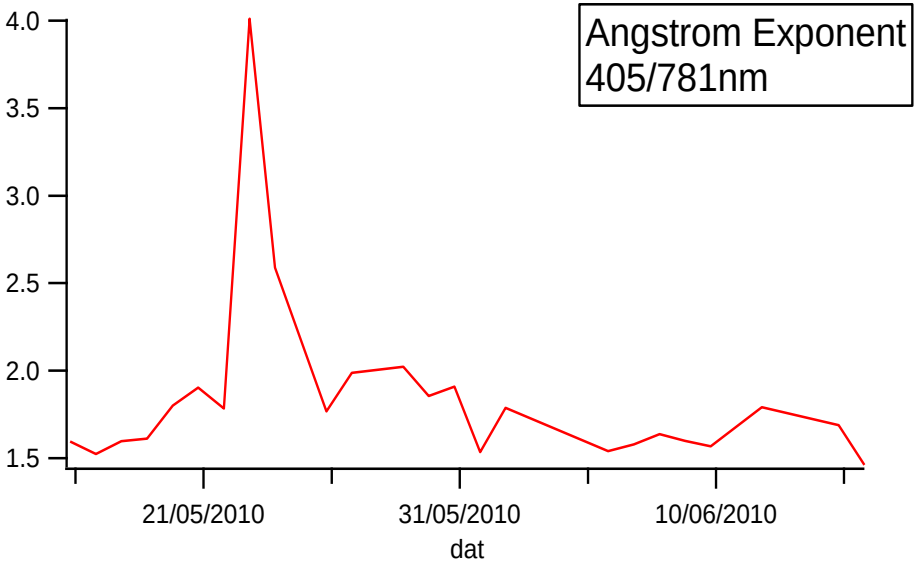
Photacoustic Angstrom exponent







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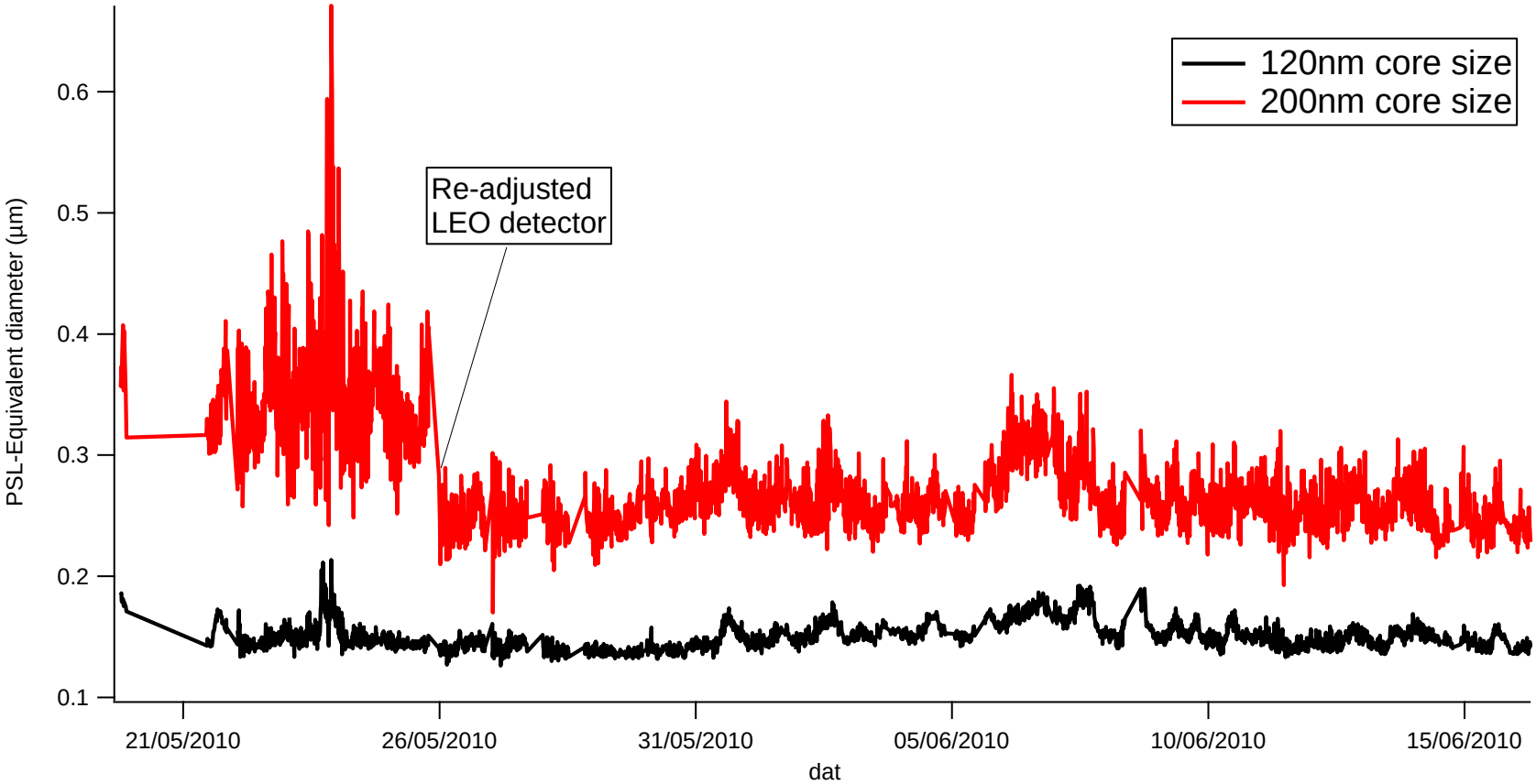
SP2 Leading Edge Only (LEO) fitted scattering signals



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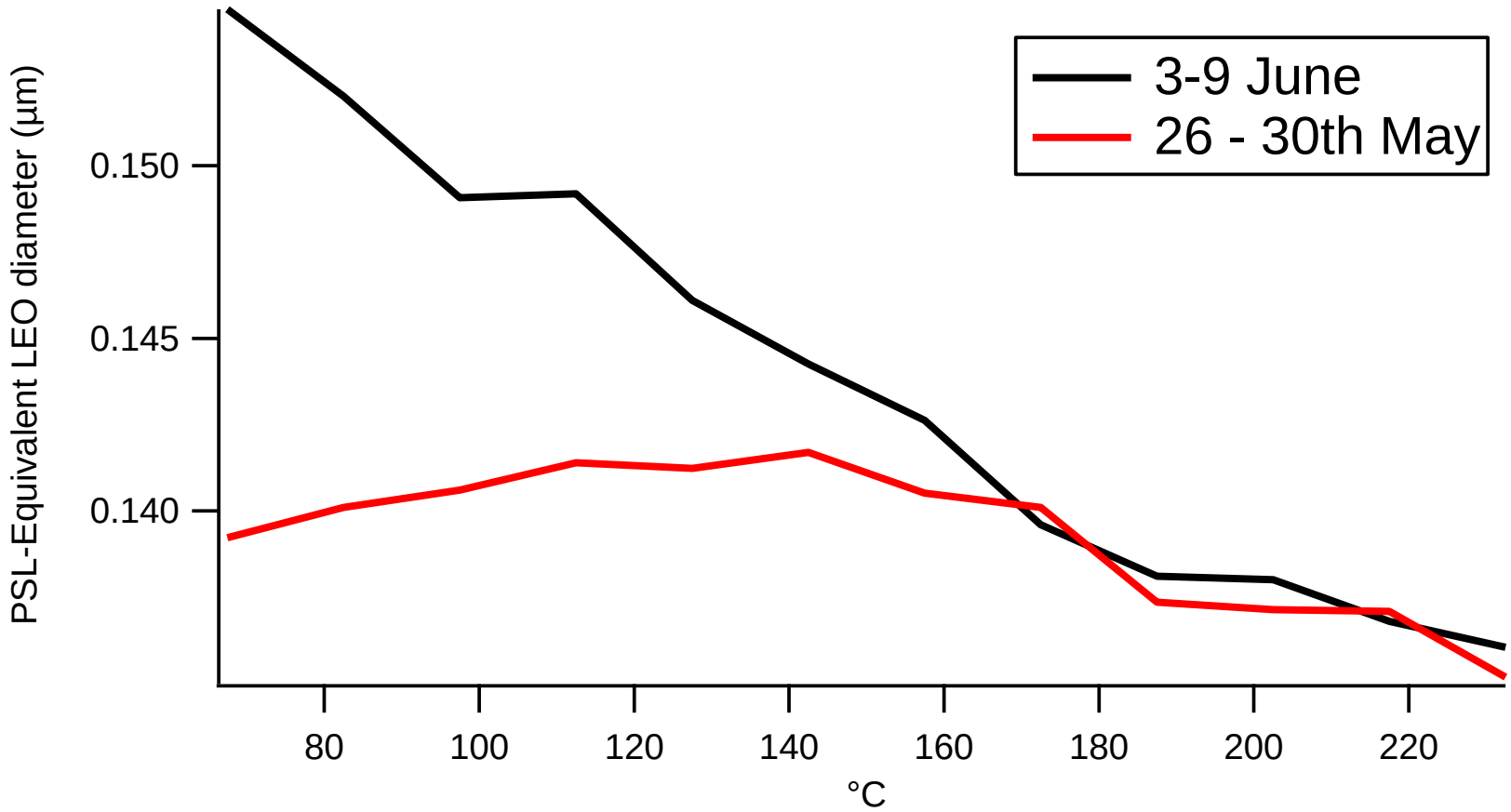
SP2 LEO 120nm cores thermogram



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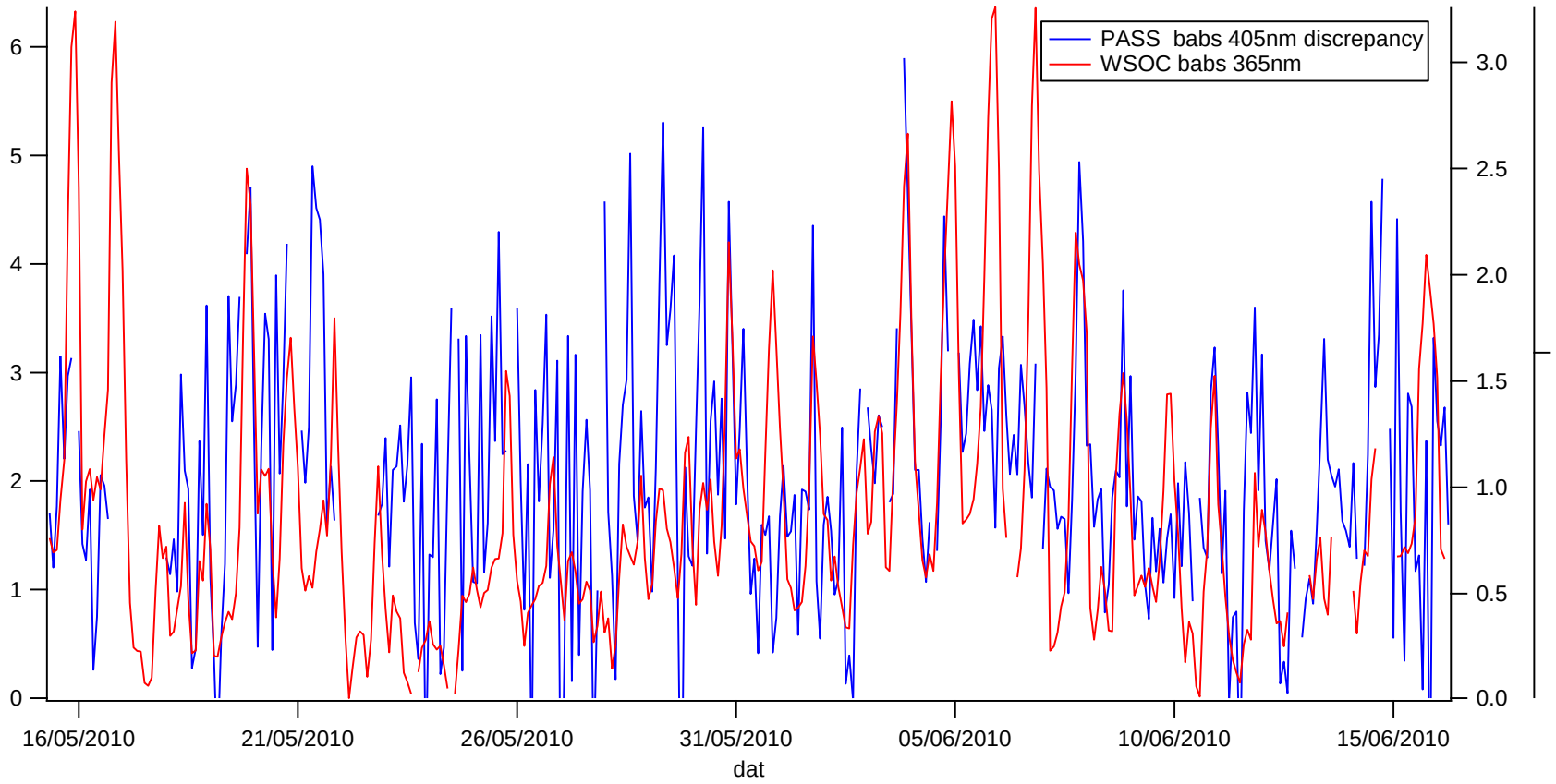
WSOC absorption



Conclusions

- The BC particles at Pasadena were found to be smaller than 'normal' and principally in the Aitken mode
- Little statistically significant variation was found in the Angstrom exponent
- Variation was found in the MAC of the particles, which can be qualitatively linked to chemical coatings through SP2, SP-AMS and thermal denuder data, however the magnitude was small (~20%)
- Need to fully quantify size-dependent losses in thermal denuder
- More work is needed to try to assess performance of models in capturing this behaviour

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