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Aerosol water: Target of opportunity and uncertainty for ARM

Measurement Uncertainties Session

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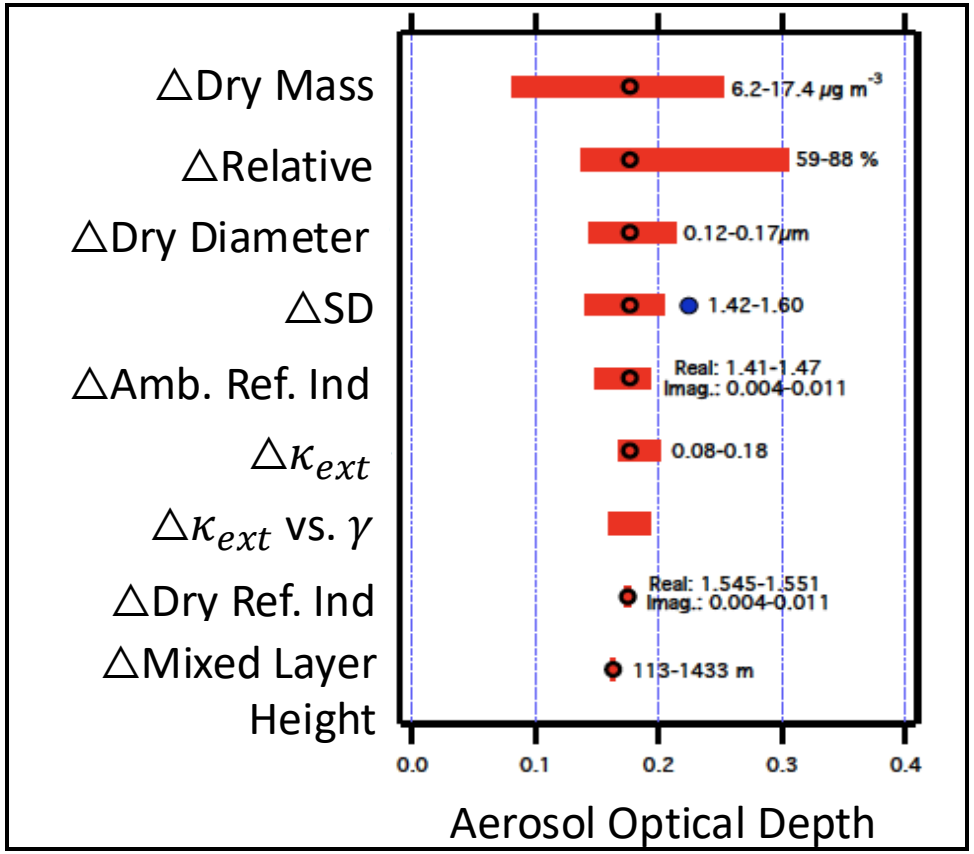
Aerosol Water: Potential Opportunities

Relationships between dry aerosol mass/composition and ambient aerosol optical properties are not well characterized

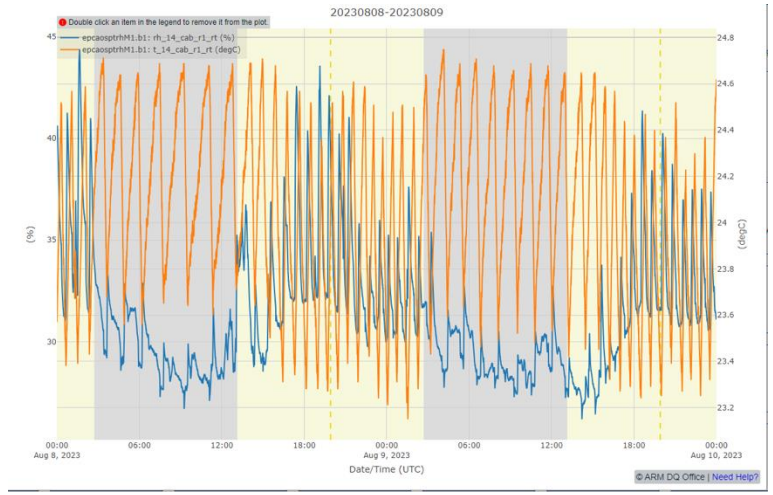
- *Climate Effects*: water accounts for a substantial proportion of ambient aerosol mass and dictates some variation in optical properties and droplet activation.
- *Measurement accuracy for in situ systems*: variations in aerosol water within measurement systems leads to uncertainties in observations of mass, composition and optical properties.
- *Linking in situ and remote sensing observations*: even for well-characterized measurement systems, linking ambient and in situ observed properties is challenging due to differences in humidity and vertical heterogeneity.



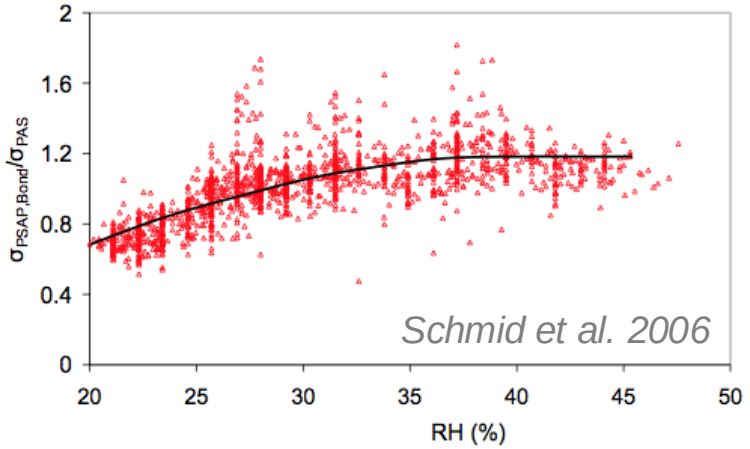
Brock et al. 2016b, ACP

Aerosol Water: Critical Roadblocks

- In situ measurement systems are not always well-controlled and/or characterized
- Support for measurement science is not consistent and coherent
- Lack of instrument development or adoption to target this problem
- Relationship among water/RH and other critical properties are not well-understood
- Community has not defined the critical set of questions and problems



RH and OA are shown to track each other in some cases and corrections for both results in increasing/decreasing biases differentially for low and high absorption coefficients



Aerosol Water: First Steps

Close the gap on both characterizing uncertainty and the relationship between dry and ambient aerosol properties

Development of new measurement diagnostics

- RH profiles for remote sensing / ambient measurements
- More precise RH tracking and control for in situ systems

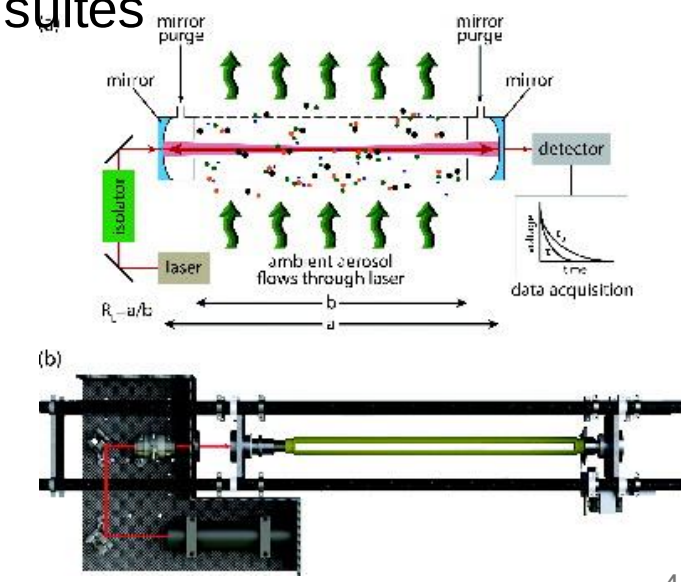
Efforts to control in situ sampling environment (invest in container design, insulation, HVAC)

Analysis approaches = closure

- dry and ambient optical closures
- aerosol-cloud droplet column/profile closure
- UAS in situ & RS profile closure

Development of instrumentation to bridge the gap

- open path extinction/scattering (ambient properties at ground level)
- RH & dry mass profiles (RS & UAS)
- targeted instrument suites
- composition & size dependency of water uptake
- more widespread use of CVI (ground & UAS)



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Aerosol optical properties calculated from size distribution measurements An uncertainty study

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