

3-laser Photoacoustic Deployment at ARM SGP site in 2009

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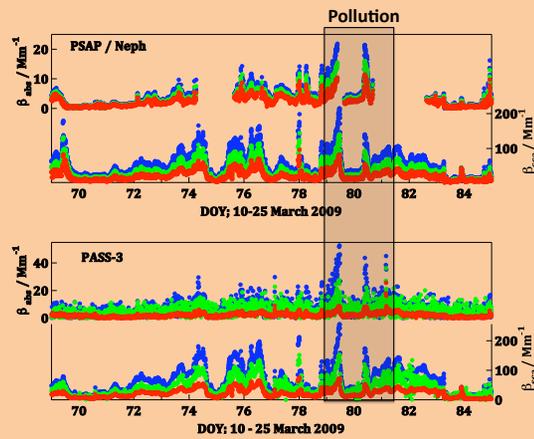
Abstract

We report the deployment of a new 3-laser photoacoustic and nephelometer (PASS-3) instrument in the Aerosol Observing System at the ARM SGP site in 2009. We compare our measurements of absorption and scattering with co-located independent measurements of absorption and scattering made with a PSAP and nephelometer, respectively. We find that the nephelometer and PASS-3 scattering agree better than 12% during the 2 week period, but this degrades during pollution periods. The PASS-3 and PSAP absorption agreement is worse, of order 30%. This is the first analysis of this data. Possible sources of errors such as differences in sizes, relative humidity and wavelength corrections as well as potential for high bias in PSAP and enhanced absorption at 405 nm by organics are being diagnosed. Our instrumental configuration is also being improved to achieve this closure.

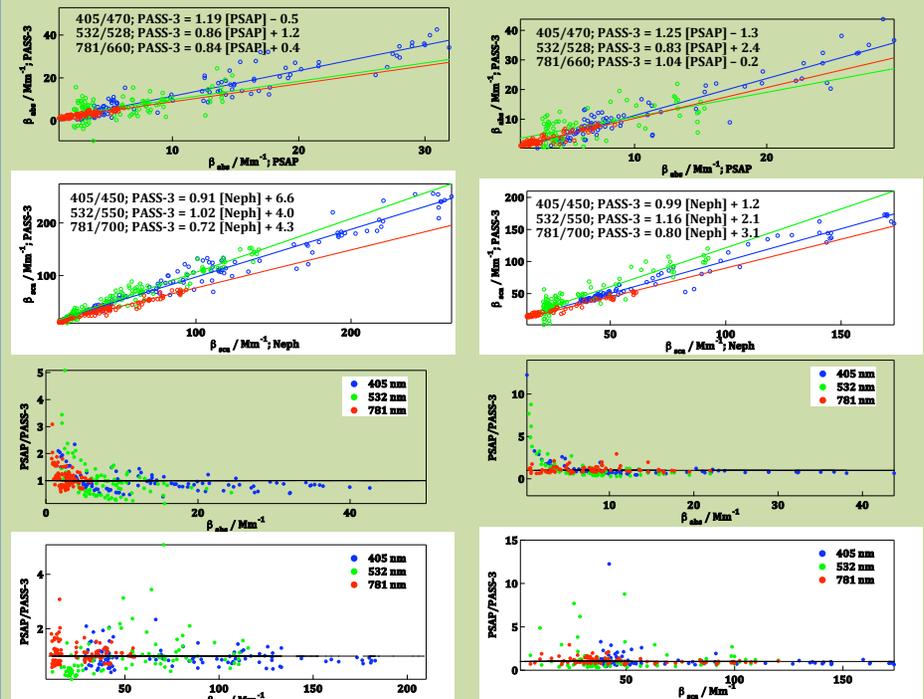
10 day continuous aerosol comparison at SGP, 15-25 March '09

- PASS-3 (DMT, Boulder, CO) measures β_{abs} , β_{scat} at 405, 532, and 781 nm using photoacoustic measurement for β_{abs} , and an integrating nephelometer for β_{scat} . β_{abs} measurement is filter free.
- Particle Soot Absorption Photometer (PSAP, Radiance Research, Seattle, WA) measures β_{abs} for aerosol collected on filter paper at 470, 528, and 660 nm. The β_{scat} measurement is from a nephelometer (TSI, Minneapolis, MN) operating at 450, 550, and 700 nm.
- The absorption and scattering Angstrom exponents (470/660 & 450/700) are used to scale the [PSAP/Neph] β_{scat} and β_{abs} to PASS-3 wavelengths for intercomparison. Both data sets are averaged for 10 min.

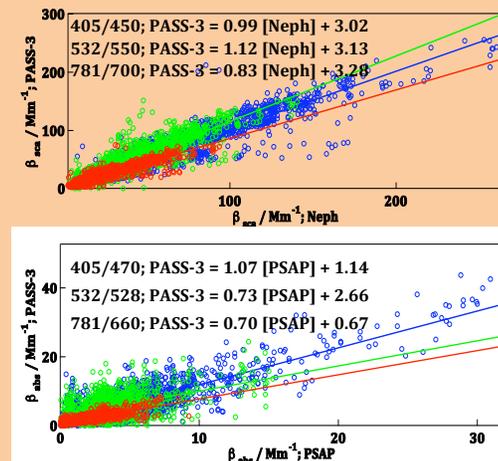
Intercomparison Study [PSAP/Neph] vs. PASS-3; 15-25 March 2009



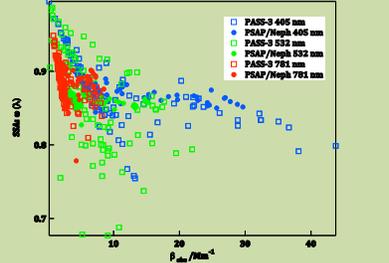
Intercomparison [PSAP/Neph] vs. PASS-3; Pollution Period March 20-21 '09



Intercomparison for entire period



Single scatter albedo, 21 March



Future: Sample, Instrument or Real Bias?

- PASS-3 upgrade to 532 nm laser and new microphone pre-amp for increased sensitivity (3x increase for β_{abs} sensitivity)
- Continued investigation of scaling PSAP/Neph β_{scat} and β_{abs} to PASS-3 using λ -dependent \tilde{A}_{scat} and \tilde{A}_{abs}
- Including PASS-3 on virtual impactor sample line: improved size resolution for intercomparison and particle loss
- Co-deployment of aerosol composition measurement to correlate PSAP/Neph and PASS-3 properties with composition

References and Acknowledgement

Lack, et al. AS & T42, 1033 (2008)
Lance, et al. J. Geophys. Res., 114, doi:10.1029/2008JD011699 (2009)
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