Aerosol Best Estimate Report

AWG and CMWG Joint Meeting
Sept. 30, 2009

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Overview: ABE Past, Present, and Future

- **The past:**
  - What is ABE? What is its purpose?
- **The present:**
  - What input data does ABE use?
  - What outputs are produced?
  - When and where has ABE been run to date?
- **The future: possibilities…**
  - Several avenues for progress are available
  - But resource competition is tight
  - Programmatic priorities should guide these efforts

What is ABE? What is its purpose?

July 19, 2002

AEROSOL PROPERTIES FOR BROADBAND HEATING RATE VAP (BBHRP)

Requirement: BBHRP is a radiation transfer model which requires aerosol inputs among other atmospheric variables. Required aerosol variables are:

1. Aerosol extinction, $\sigma_{ep}(\lambda,z,t)$, a function of wavelength, altitude, and time
2. Aerosol single scattering albedo, $\omega_0(\lambda,z,t)$, a function of wavelength, altitude, and time
3. Asymmetry parameter, $g(\lambda,z,t)$, a function of wavelength, altitude, and time

NOTE: For shortwave radiation transfer considered here aerosol properties are required only during daylight hours.

1) Aerosol extinction [illegible]([illegible],z,t)
2) Single scattering albedo [illegible]([illegible],z,t)
3) Asymmetry parameter g([illegible],z,t)

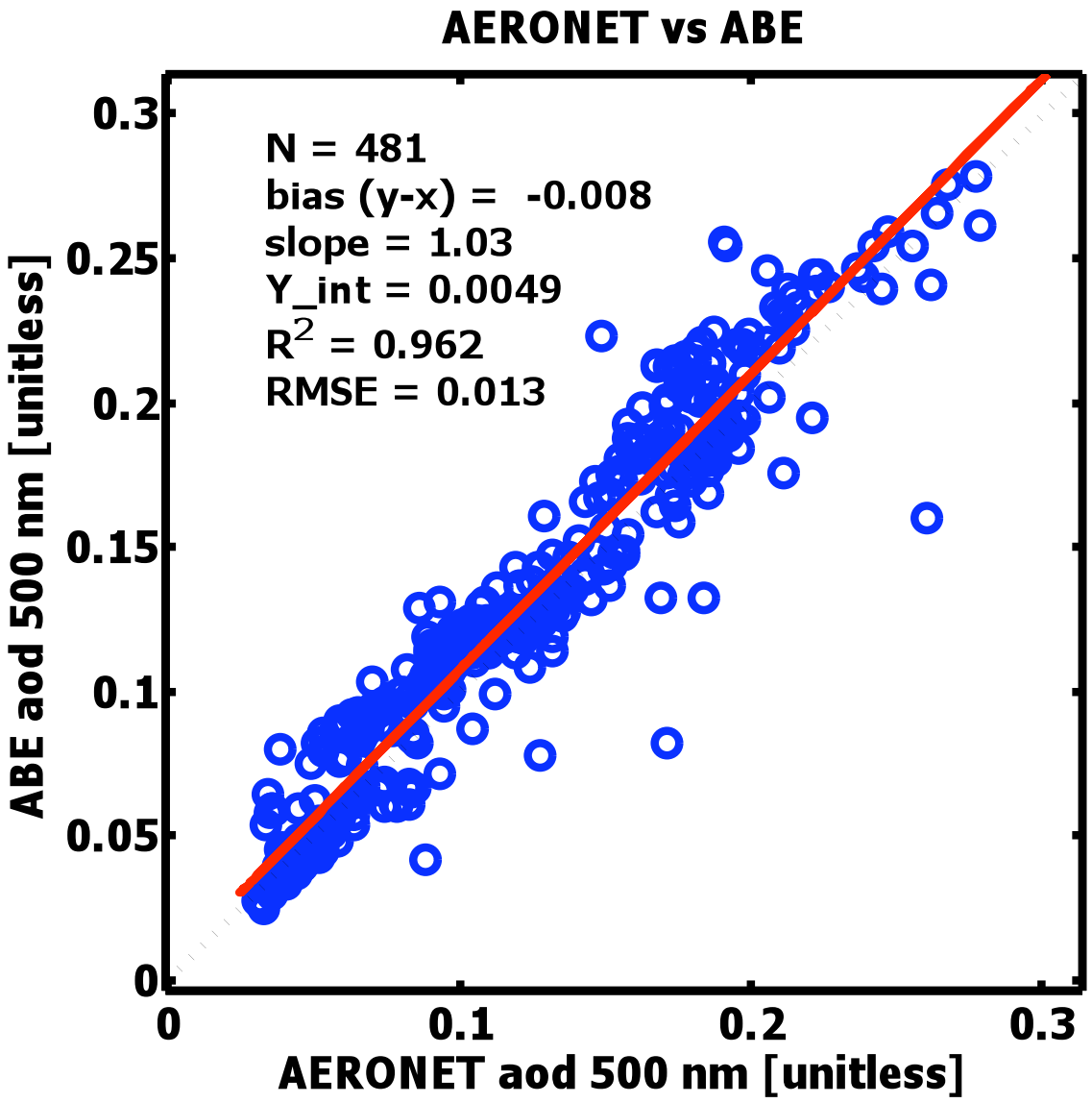
Year-long BBHRP runs demand continuity

- Strategy was to develop a baseline product with the minimum number of inputs having the highest reliability.
- Initially use only AOD(λ,t), rh(z,t), and AOS(λ,rh,t)
  - Determine AOD and Å from sun photometer, MFRSR, or NIMFR.
  - Convert to aerosol extinction profile using seasonal mapping of λ(z) vs. AOD at SGP from RL climatology.
  - Compute ambient profiles of total scattering from surface dry total scattering measurement and hygroscopicity function f(RH).
  - Extend dry absorption coefficient measurements vertically to yield $\lambda(z) = \lambda_s(z)/(\lambda_s(z) + \lambda_a(z))$
  - Compute ambient profiles of hemispheric backscattering to yield backscatter fraction b(z) and eventually g(z).

Final results generated:

- Monthly data file on 10-minute grid
  - Column AOD and Angstrom exponent
  - Aerosol extinction profile at 500 nm, 39 m resolution
  - RH profile, 39 m resolution
  - Single scattering albedo at 500 nm, 39 m resolution
  - Asymmetry parameter g at 500 nm, 39 m resolution
- Substantial effort devoted to logic for interpolation, extrapolation, or substitution for missing measurements.
  - Captured in file with flags indicating source of value
- SGP: 2001 – 2007 at archive as eval product
- NSA: Jan 2004 – Feb 2005, at archive as eval product
  - **Jan-Dec 2008: reviewed, ready for release**

Aerosol Best Estimate AOD, Barrow 2008
Independent comparision with AERONET



- Slope = 1.03
- Bias = -0.008
- R^2 = 0.962
- RMSE = 0.013

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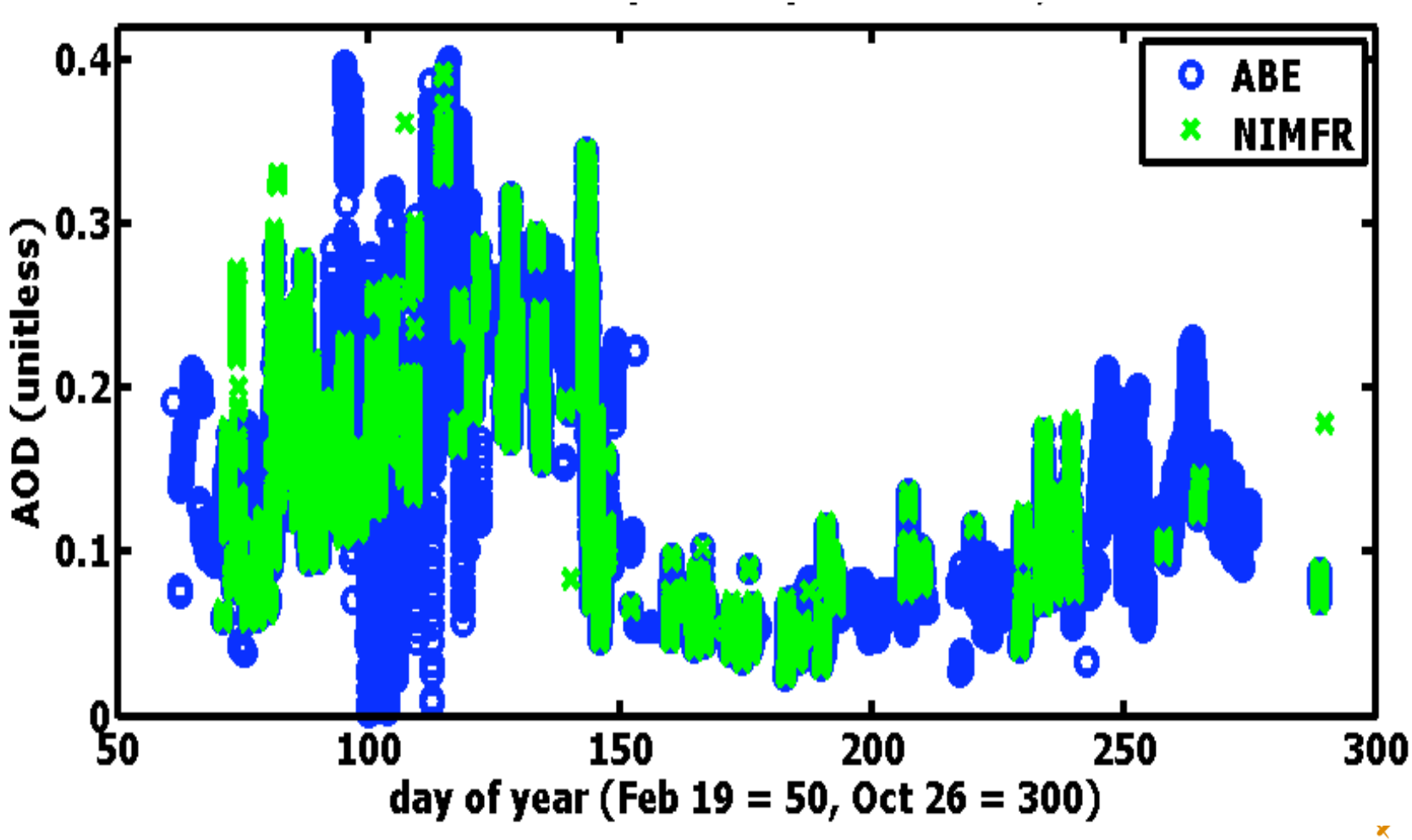
Aerosol Best Estimate AOD, Barrow 2008
Time Series for 2008



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The future: some possibilities…

- Improve AOD with redundancy and radiative closure
- Fold in 3-wavelength absorption measurements
- Run baseline ABE for AMF
- And for AMF2 and TWP Darwin when AOS available.
- Improve continuity using climatologies, model defaults - ala SBDART default aerosol properties.
- Incorporate in situ and lidar profiles?
- Other related quantities to include? Sub-micron fraction?
- New measurements? E.g. CCN SS, size mode, etc.