Vertical Profiles of Light-Absorbing Aerosol: In-situ and AERONET Observations during NASA DISCOVER-AQ

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Objectives and Impacts

1. Assess AERONET AAOD retrievals using in-situ observations to evaluate the use of model scaling factors
2. Evaluate the AAOD-SSA relationship and dependence on other atmospheric variables

Conclusions and Future Work

- AERONET AAOD is significantly greater than in-situ
- Low AOD and AAOD values make retrievals uncertain, but minimize absolute differences
- SSA generally agreed to ±0.02

Introduction

Understanding the vertical profile of aerosols plays a vital role in utilizing spaceborne, column-integrated satellite observations. The properties and distribution of light-absorbing aerosols are particularly uncertain despite significant air-quality and climate ramifications. The NASA DISCOVER-AQ project motivated a statistical assessment of spatial, temporal, and source-related variability for light-absorbing aerosol properties in these distinct regions.

1. Vertical Profiles

- Absorption coefficient was measured by a particle soot absorption photometer (PSAP) at 470, 532, and 660 nm wavelengths, corrected by Virkkula et al. 2010.
- Profiles were observed during P-3B spirals over 6-8 ground sites 3 times daily, in each region (below).

2. Laboratory Absorption Measurement Validation

- PSAP measurements suffer from uncertainties and filter artifacts
- Laboratory observations using a DMT PASS-3 (photo-acoustic) showed excellent agreement for soot and dust aerosol

3. AERONET Comparison

- AERONET measurements are available at each spiral location and many additional sites throughout each region.
- Profiles at many locations extend to ~20m above the surface (left).
- In-situ profiles covered a significant portion of the day, 09:00 to 17:00 (local).
- AERONET retrieval of AAOD rely on almucantar scans that occurred at ~10:00 and 16:00 (local), except at SJV (above).
- Profiles suggest very different dynamics at each site, especially SJV and CO where a shallow BL limited the aerosol vertical extent.

4. Influencing Factors

-好AOD and AERONET in-situ correlation observed at AOD > 0.1, especially for DC and CO
- AERONET AAOD consistently exceeds in-situ by ~2x (L-1.5) and ~4x (L-2.0) for both wavelengths (above)
- Linear correlation between AAOD measurements is weak
- Significant absorption coefficients (and unrealistic BC mass concentrations) would be necessary at the surface to explain AERONET discrepancy (left)

**STEER (Statistical Evaluation of Aerosol Retrievals) – PI: Greg Schuster**