Aerosol Optical Depth and Extinction Obtained from Airborne Sunphotometer, Airborne In-Situ (CIRPAS Twin Otter) and Spaceborne Measurements During ACE-Asia

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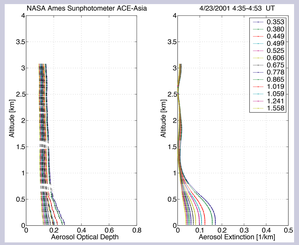
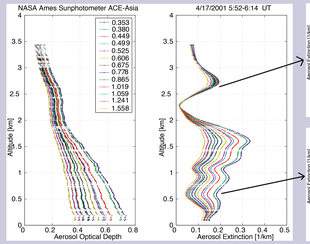
AATS-14 Profiles

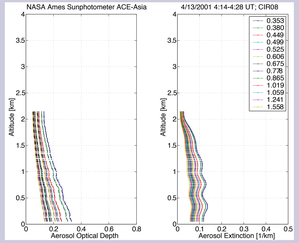
April 23



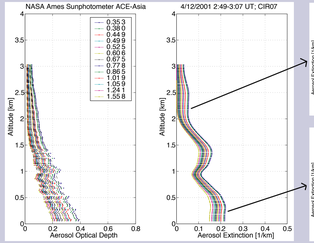
April 17



April 13



April 12



AATS-14 Size Information

Traditional Ångström Law

AOD ([]) or Ext ([]) = [] $^{-[]}$

small [] = large particles
larger [] = small particles

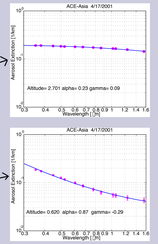
or

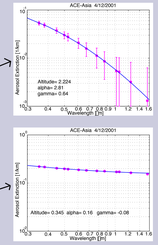
log [] AOD ([]) / Ext ([]) = log [] - []log []

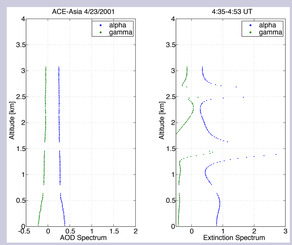
AOD ([]) or Ext ([]) rarely linear in log-log space therefore

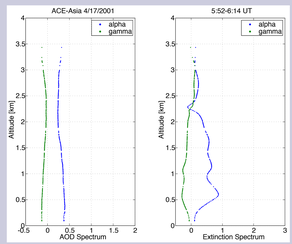
Extension of Ångström law

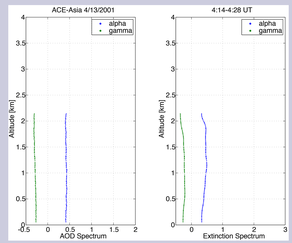
log [] AOD ([]) / Ext ([]) = log [] - []log [] - []log []^2

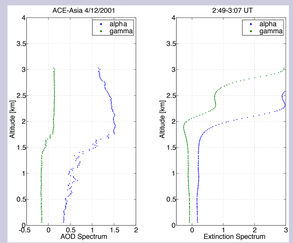




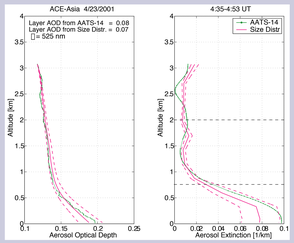


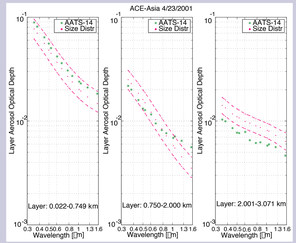


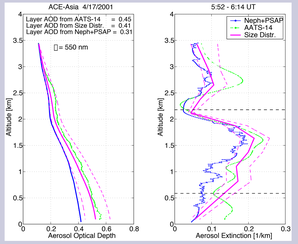


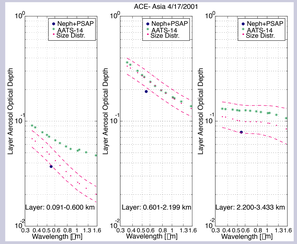


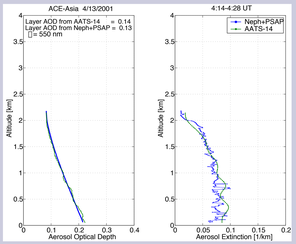
AATS-14 vs. In-Situ

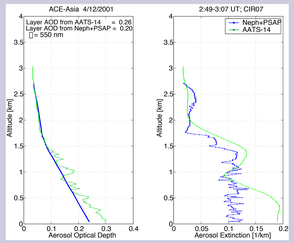












NASA Ames Airborne Tracking Sunphotometer: AATS-14

CIRPAS Twin Otter

- Measures direct solar beam transmission @:

353.5 380.0 449.0 499.4 525.0 605.7 675.1
778.4 864.5 939.7 1019.1 1059.4 1241.3 1557.8 nm

-Yields:
- aerosol optical depth +
- aerosol extinction when A/C flies profiles

- columnar water vapor (ozone) +
- water vapor (ozone) concentration when A/C flies profiles

-Size:
- Telescope dome 8" OD (hemisphere)
- atop 5" H pedestal. (Total H: 9" above A/C skin)
- Inside A/C: 12" D x 18" H cylinder.

-Weight:
- 131.6 lbs

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Preliminary findings involving the NASA Ames sunphotometers: (see also poster by Redemann et al.)

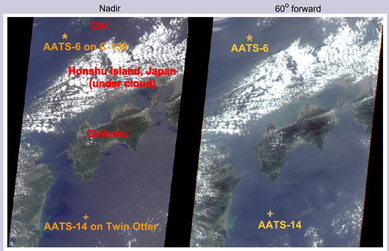
1) The wavelength dependence of sunphotometer-derived AOD and extinction indicates that supermicron dust was often a major component of the aerosol, frequently extending to high altitudes. In data flights analyzed to date the percentage of full-column AOD (525 nm) that lay above 3 km was typically 34±13%. In contrast, the analogous percentage of precipitabel water vapor was only 10±4%.

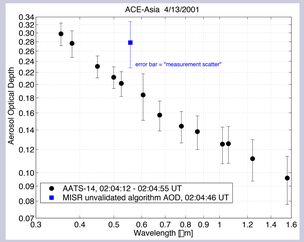
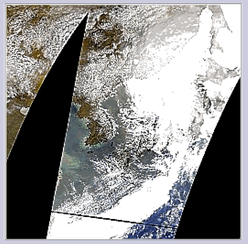
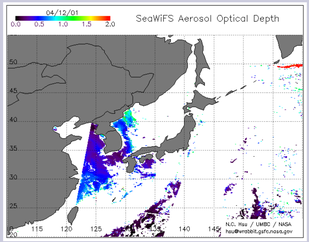
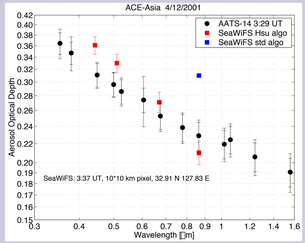
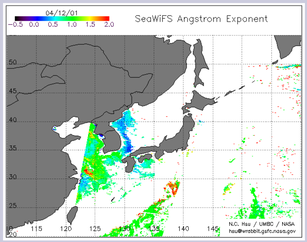
2) Initial comparisons of aerosol extinction derived from in situ measurements aboard the Twin Otter (nepheloimeters + PSAP, or computed from size distribution) and AATS-14 show good agreement regarding the vertical distribution of aerosol layers. The agreement in absolute magnitude of aerosol extinction/optical depth varied between the instruments and the various layers sampled. Compared to AATS-14, in the average, total layer AODs from nepheloimeters + PSAP are lower by 20%, and lower by 11% if computed from in-situ size distribution.

3) First comparisons of sunphotometer-derived AOD to preliminary MISR-derived AOD show that AODs from the unvalidated MISR algorithm exceed sunphotometer-derived AODs.

4) First comparisons of sunphotometer-derived AOD to preliminary SeaWiFS-derived AOD show very good agreement if the algorithm of Hsu et al. is used but poorer agreement if the standard algorithm is used.

AATS-14 vs. MISR





AATS-14 vs. SeaWiFS