Airborne sunphotometer measurements of aerosol optical depth and water vapor in ACE-Asia and their comparison to correlative measurements

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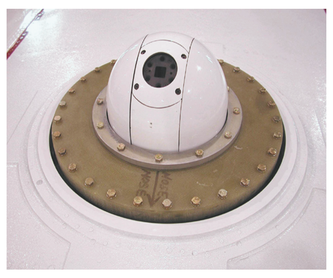
NASA Ames Airborne Tracking Sunphotometer: AATS-6



- Measures direct solar beam transmission @ :
380.1 450.9 525.7 864.5 941.9 1021.3 nm

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

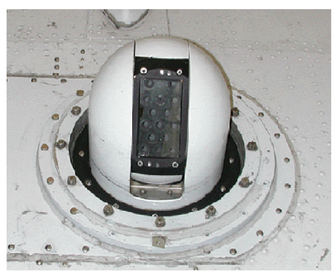
columnar water vapor +
water vapor conc. when A/C flies profiles

-Size:
Telescope dome 8" OD x
Overall telescope height ~15"
Extends ~6" above A/C skin, 9" below

-Weight:
62 lbs. (+39 lbs control system)

NASA Ames Airborne Tracking Sunphotometer: AATS-14

- 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

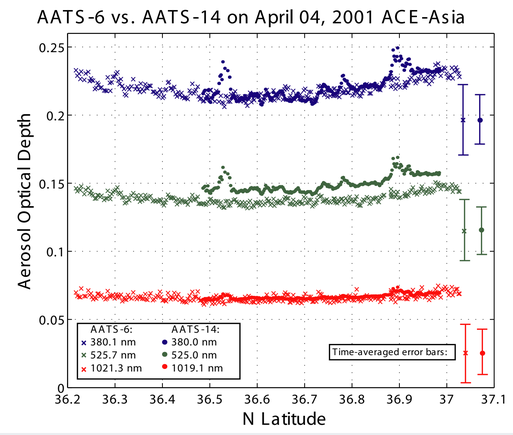


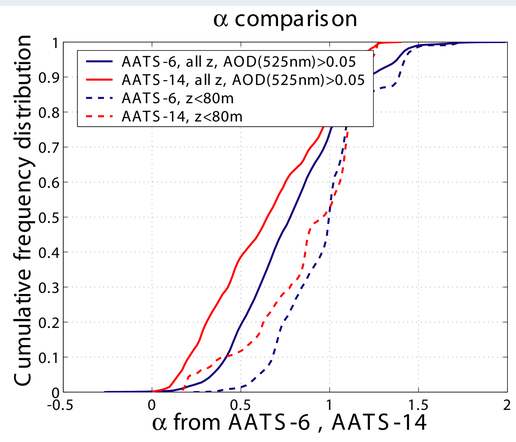
-Yields:
aerosol optical depth +
aerosol extinction when A/C flies profiles

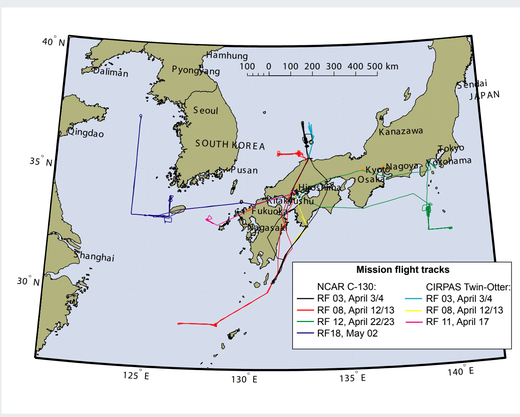
columnar water vapor +
water vapor conc. when A/C flies profiles

-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.

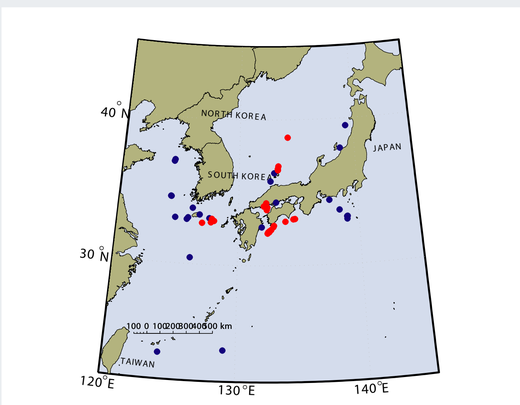
-Weight:
131.6 lbs



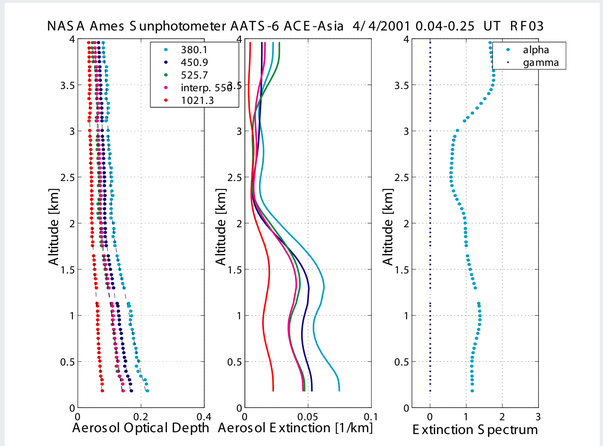




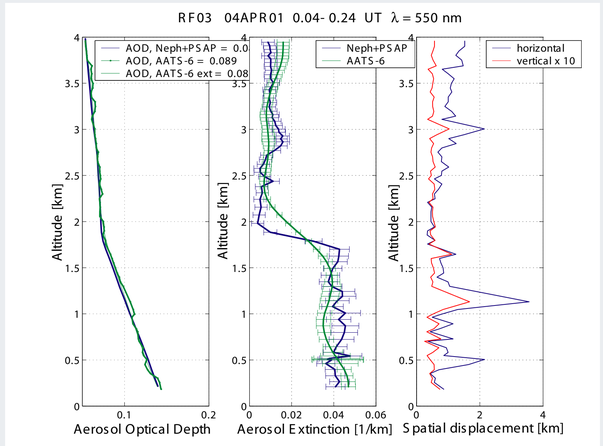
Selected AATS-6 (C-130) and AATS-14 (Twin-O.) flights



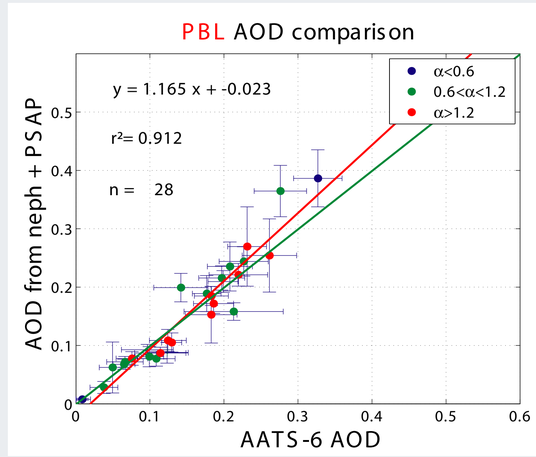
AATS-6 Profiles

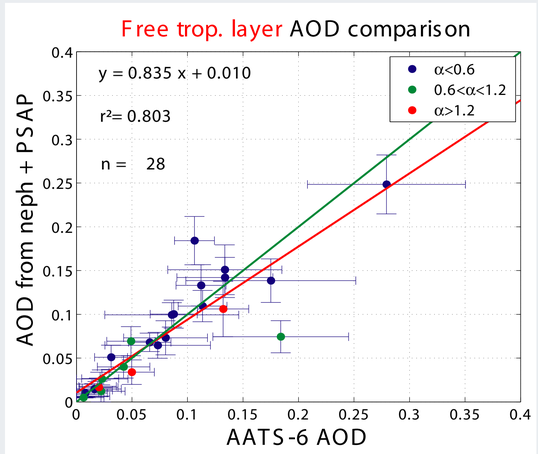


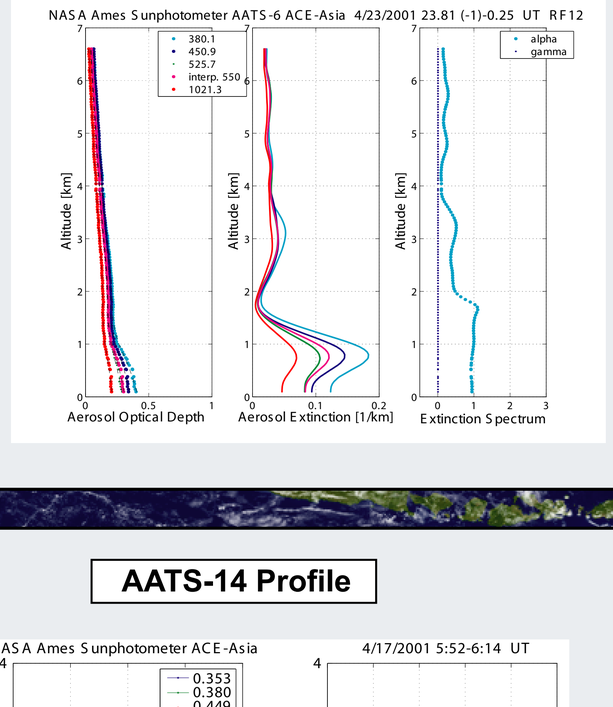
AATS-6 vs. In-situ

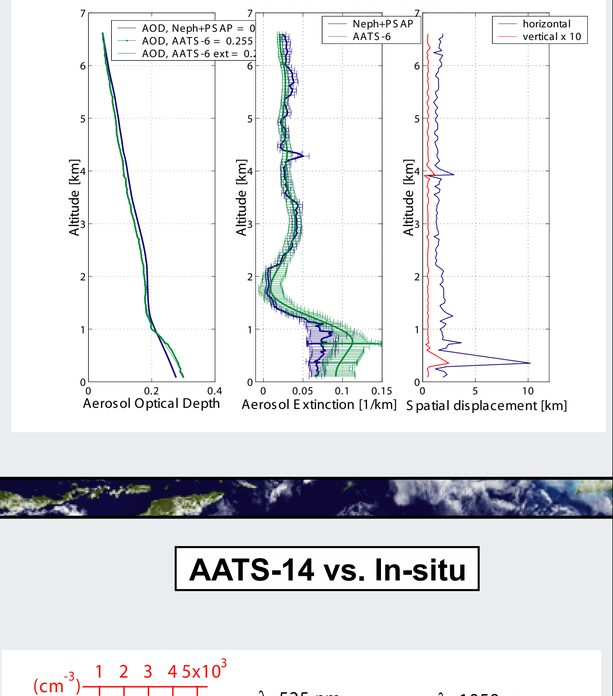


AATS-6 vs. In-situ AOD, extinction comparisons

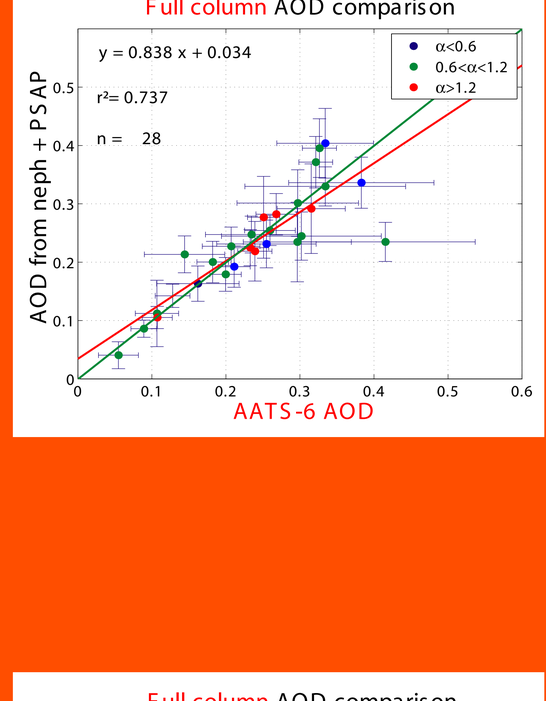


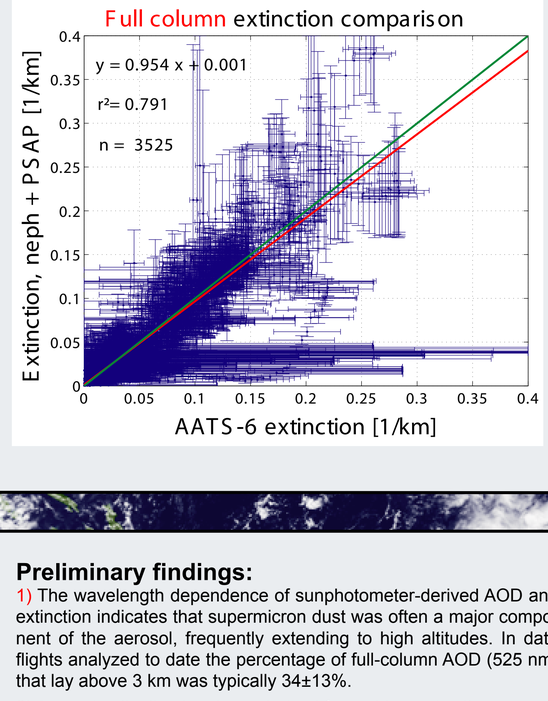




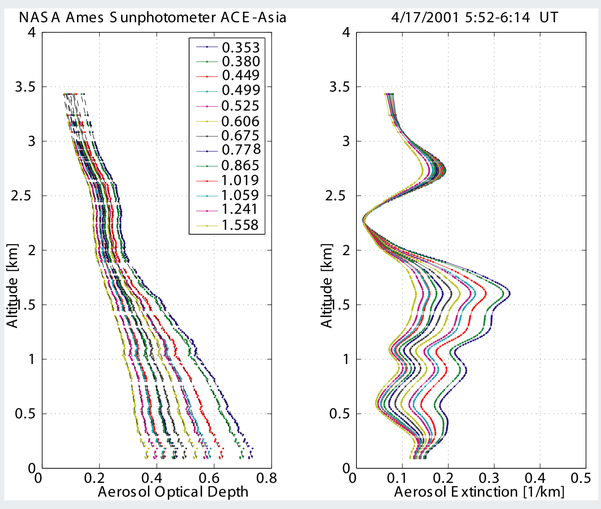


Full column AOD comparisons

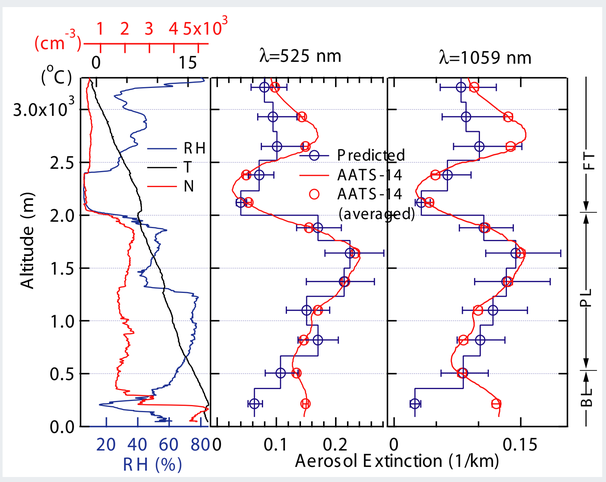




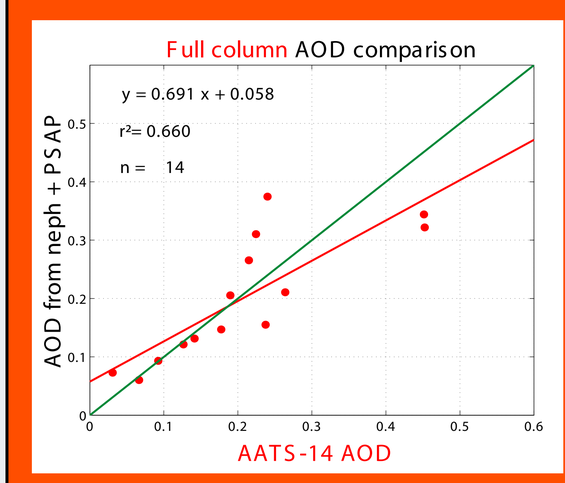
AATS-14 Profile



AATS-14 vs. In-situ



Full column AOD comparison



Preliminary findings:

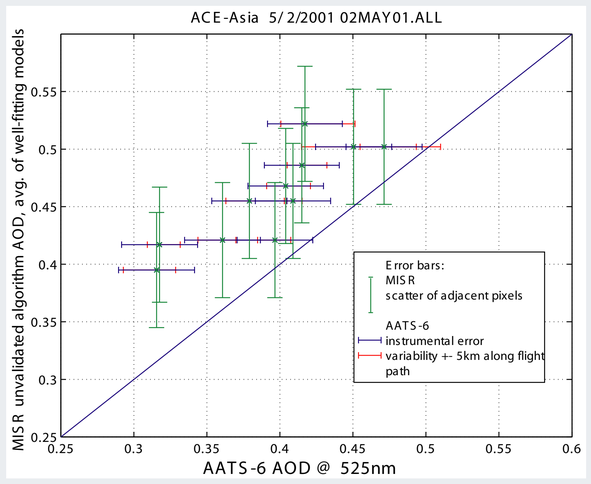
1) The wavelength dependence of sunphotometer-derived AOD and extinction indicates that supermicron dust was often a major component of the aerosol, frequently extending to high altitudes. In data flights analyzed to date the percentage of full-column AOD (525 nm) that lay above 3 km was typically 34±13%.

2) Aerosol extinction has been derived from airborne in situ measurements of scattering (nephelometers) and absorption (particle soot/ absorption photometer, PSAP) or calculated from particle size distribution measurements (mobility analyzers and optical particle counters). Comparison with corresponding extinction values derived from AATS-14 measurements shows good agreement for the vertical distribution of aerosol layers. On average, total layer AODs calculated from the combination of nephelometer and PSAP data are ~25% less than those calculated from AATS-14 measurements, and corresponding values calculated from in-situ size distribution measurements are 11% less than AATS-14 layer AODs.

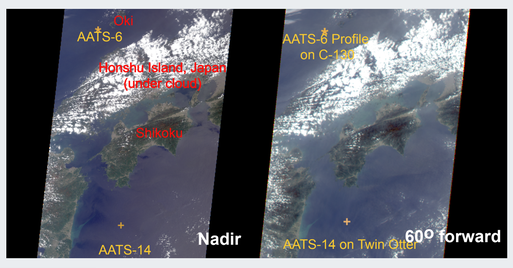
3) A comparison of AATS-6- vs. in situ-derived extinction shows that in general, the aerosol taken in by the NCAR C-130 LTI can account for all the ambient aerosol extinction within the measurement uncertainties. Further from the AOD comparisons, there seem to be no significant differences when comparing the LTI performance in the boundary layer vs. the free troposphere (although there is a tighter correlation in the PBL AOD comparison). However, for the free trop. layer with dust, our comparisons show a slight tendency of the LTI to oversample large particles (as expected).

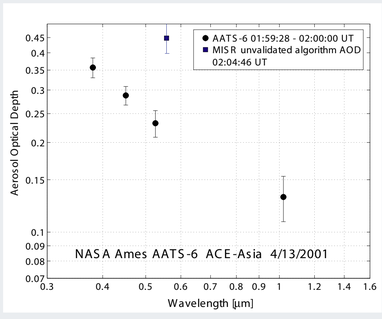
4) Initial comparisons of sunphotometer-derived AOD to preliminary MISR-derived AOD show that AODs from the unvalidated MISR algorithm exceed sunphotometer-derived AODs. Initial comparisons of sunphotometer-derived AOD to preliminary SeaWiFS-derived AOD show very good agreement if the algorithm of Hsu et al. is used, but poorer agreement if the standard algorithm is used.

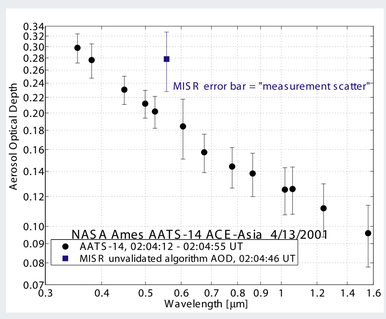
AATS/ MISR Comparisons



MISR Images
ACE-Asia
April 13, 2001







AATS-14/ SeaWiFS Comparisons