Airborne Sunphotometry and Integrated Analyses of Dust, Other Aerosols, and Water Vapor in the Puerto Rico Dust Experiment (PRIDE)

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Objectives:

1. Improve understanding of dust, other aerosol, and water vapor effects on radiative transfer, radiation budgets and climate in the Caribbean region.
2. Test and improve the ability of satellite remote sensors (such as MODIS, MISR, CERES, TOMS, AVHRR) to measure these constituents and their radiative effects.

Tasks:

(a) Integrate the 6-channel Ames Airborne Tracking Sunphotometer on the SPAWAR Navajo aircraft.
(b) Calibrate AATS-6 before and after PRIDE.
(c) Provide continuous realtime measurements of aerosol and thin cloud optical depth spectra and water vapor column contents during PRIDE flights (e.g., transects across dust gradients, vertical profiles through aerosol layers).
(d) Use these data in flight direction and planning.
(e) Compare results to those of the satellite sensors listed above (cf. Figure 1a,c); in cases of disagreement, investigate causes and retrieval algorithm improvements.
(f) For aircraft profiles derive profiles of aerosol extinction spectra (cf. Figure 1b,d) and water vapor density.
(g) Combine these data with those from the Pilewskie SSFR and conduct new analyses of aerosol radiative forcing sensitivity, single scattering albedo, and the solar spectral radiative energy budget.
(h) Derive aerosol size distributions from optical depth and extinction spectra.
(i) Combine data with in situ measurements of chemical composition, size distribution, hygroscopic growth, and single-scattering albedo to provide tests of closure and integrated assessments of aerosol and trace gas radiative effects.

Outputs (what and when):

1. Aerosol and thin cloud optical depth spectra (380 to 1020 or 1558 nm) and water vapor column contents, in real time color displays. Produced continuously throughout A/C flight when sunphotometer's view of sun is not blocked by thick clouds ($\tau > \sim 3$) or A/C obstructions (e.g., tail, antennas).
2. For A/C profiles, haze extinction spectra profiles (380 to 1020 or 1558 nm) and water vapor concentration profiles. Produced after flight from smoothed profiles of data resulting from #1. Requires reasonable horizontal/temporal homogeneity.
3. Integrated analyses (see above) and publications. Produced several months to years after measurements, depending in part on availability of others' data and analyses, plus funding levels.

Activity Timetable, FY2000:

Jan-Feb:	Funding Decision
Feb-Apr:	A/C Integration Planning, Fit Checks
May:	Pre-Campaign Sunphotometer Aerosol/Water Vapor Calibration, Mauna Loa Observatory
1-21 Jun:	A/C Integration and Test Flights
26 Jun-21 Jul:	PRIDE Deployment, Roosevelt Roads, PR
Aug-Oct:	Post-Campaign Sunphotometer Aerosol/ Water Vapor Calibration, Mauna Loa Observatory

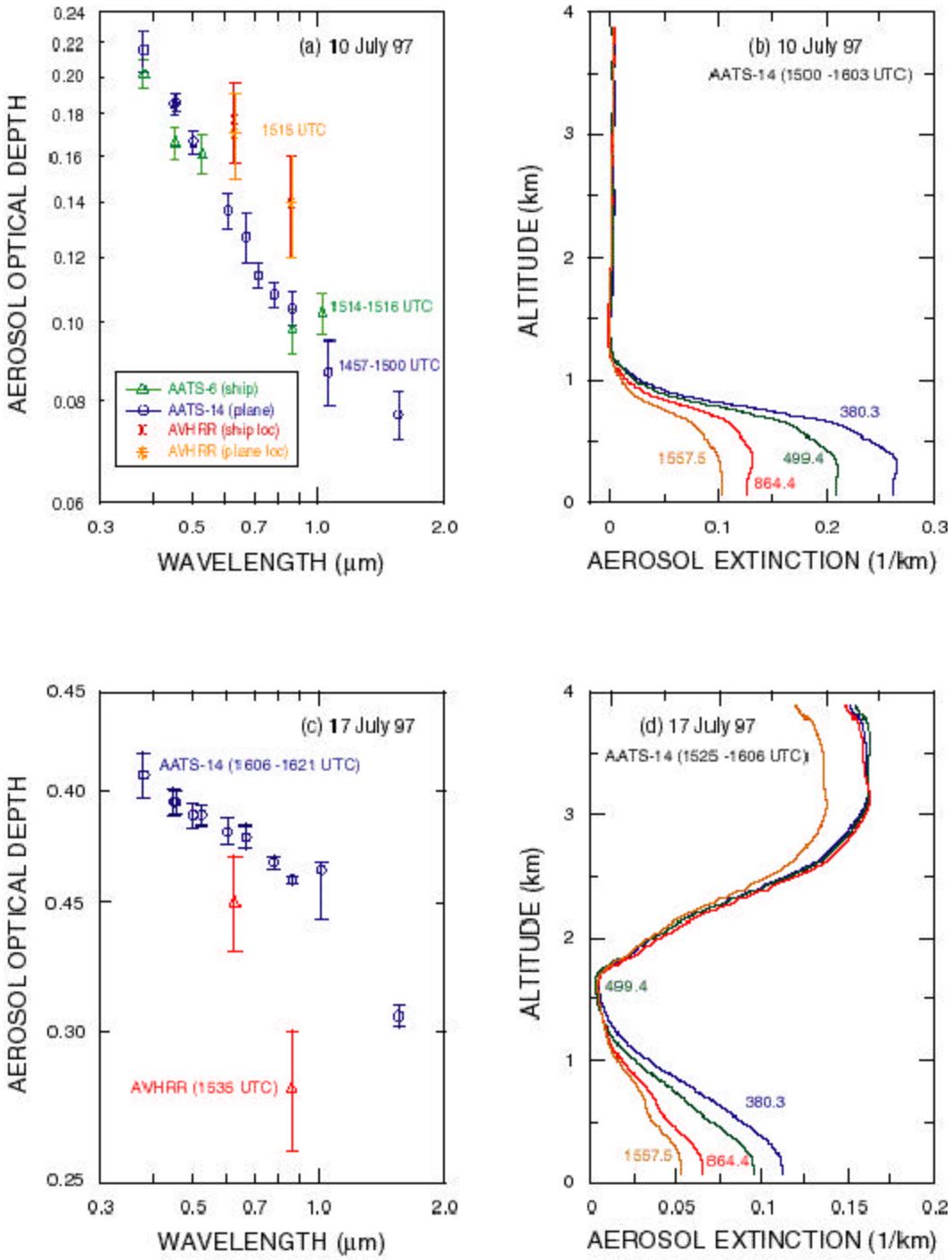

Figure 1. (a) Comparison between aerosol optical depths derived from AVHRR radiances and measured by AATS-14 on the Pelican aircraft and AATS-6 on the ACE-2 ship, for a case with no elevated dust layer present. (b) Vertical profiles of aerosol extinction coefficient for the case in (a). (c) Comparison between aerosol optical depths derived from AVHRR radiances and measured by AATS-14, for a case with an elevated dust layer. (d) Vertical profiles of aerosol extinction coefficient for the case in (c).