

THREE DIMENSIONAL INVESTIGATION OF LOWER TROPOSPHERIC
AEROSOL AND WATER VAPOR DURING ACE-2 BY MEANS OF AIRBORNE
SUNPHOTOMETRY

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The NASA Ames 6-channel (AATS-6) and 14-channel (AATS-14) airborne tracking sunphotometers were operated during the second Aerosol Characterization Experiment (ACE-2) that took place over the eastern Atlantic Ocean in summer 1997. AATS-6 was developed at Ames in 1984 and has been operated aboard a variety of aircraft and from the ground in numerous stratospheric and tropospheric field studies (e.g. Russell et al., 1993; Russell et al., 1998). During ACE-2, AATS-6 was operated aboard a ship, the Ukrainian R/V Vodyanitskiy (see Livingston et al. this session).

An extended version of AATS-6, AATS-14 was developed at Ames in 1996. Prior to ACE-2 it had been operated on a limited number of flights during TARFOX (Tropospheric Aerosol Radiative Forcing Experiment) in July 1996 (Russell et al. 1998). During ACE-2, based in Tenerife (28.5° N, 16.3° W), AATS-14 was operated during 17 flights aboard the single-engine modified Cessna airplane, the Pelican, which is operated by the Marina, California Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS). AATS-14 measures spectral aerosol optical depth (AOD) at 13 wavelengths bands covering the region from 380 to 1558 nm and retrieves the columnar water vapor (CWV) with the aid of a channel centered at 940 nm (Schmid et al., 1996).

The Pelican was able to fly as low as 30 m above the ocean surface, thus allowing measurement of the entire overlying atmospheric column. Maximum (but constant) altitude (~3.8 km) flights during sunset allowed us to perform three successful in-flight Langley-plot calibrations of AATS-14. Having the Pelican fly narrow up or down spirals allowed us to retrieve vertical profiles of AOD and CWV. Differentiation of those profiles leads to aerosol extinction (see Fig. 1) and water vapor density profiles. Finally we estimate aerosol size distributions by inverting layer optical depth spectra.

Special emphasis will be placed on results derived from flights performed on July 8 and 17, 1997. On both days, the marine boundary layer and a higher layer containing

Sahara dust can be characterized. Comparisons will be made with an aerosol lidar, ground-based sun photometers, satellite retrievals and in-situ measurements aboard the Pelican.

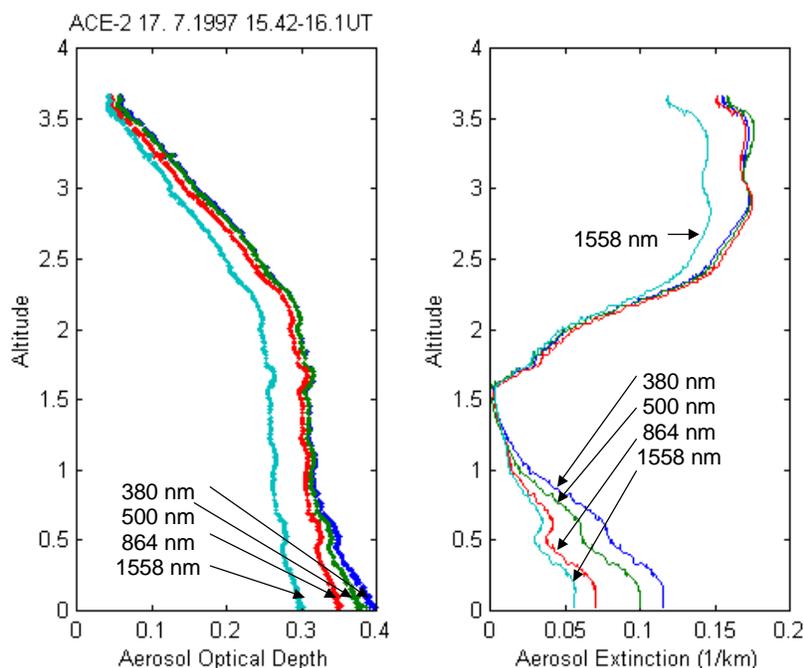


Figure 1: Left panel: Profiles of aerosol optical depth at four selected AATS-14 wavelengths measured in ACE-2 south of the coast of Tenerife. Right panel: Aerosol extinction profiles derived by differentiating the profiles in the left panel. The marine boundary layer and an elevated Sahara dust layer can be characterized.

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