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TITLE:

Clear column closure studies of urban-marine and mineral-dust aerosols using aircraft, ship, and satellite measurements in ACE-2

ABSTRACT:

During the second Aerosol Characterization Experiment (ACE-2), European urban-marine and African mineral-dust aerosols were measured by the Pelican aircraft, the Research Vessel Vodyanitskiy, and NOAA satellites. The Pelican measured aerosol optical depth and extinction spectra, water vapor columns and vertical profiles using a 14-channel sunphotometer; aerosol absorption coefficient and 3-wavelength scattering coefficients using an absorption photometer and nephelometer; aerosol scattering humidification factors using a passive humidigraph; and aerosol size distributions using a differential mobility analyzer and two optical particle sizers. The R/V Vodyanitskiy measured optical depth spectra and water vapor columns using a six-channel tracking sunphotometer, plus aerosol size distributions and chemical compositions using the NOAA-PMEL shipboard suite. The NOAA-12 and NOAA-14 satellites measured upward-scattered radiances using AVHRR sensors, from which 2-wavelength aerosol optical depths were derived. To assess the mutual consistency between the measurements and the models or retrieval

techniques that link them, we show comparisons among the above properties, as well as the derived or assumed spectra of single-scatter albedo and scattering phase function. Results show that achieving closure, or mutual consistency, depends critically on the methods used to account for aerosol hygroscopic growth, internal or external composition mixtures, and the particle-size cutoffs of different sampling instruments.