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AIRBORNE HIGH SPECTRAL RESOLUTION LIDAR MEASUREMENTS OF ATMOSPHERIC AEROSOLS

Ferrare, R., Hostetler, C., Hair, J., Cook, A., Harper, D., Al-Saadi, J., and Szykman, J.,
NASA Langley Research Center, Hampton, VA 23681

Kleinman, L., Brookhaven National Lab, Brookhaven National Lab, Upton, NY 11973

Clarke, A., University of Hawaii, Department of Oceanography University of Hawaii, Honolulu, HI 96822

Russell, P. and Redemann, J., NASA Ames Research Center, Moffett Field, CA 94035

Livingston, J., RI International/NASA Ames, SRI International, Menlo Park, CA 94025

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Environmental Sciences Department/Atmospheric Sciences Division
Brookhaven National Laboratory
P.O. Box, Upton, NY
www.bnl.gov

ABSTRACT

NASA Langley Research Center (LaRC) recently developed an airborne High Spectral Resolution Lidar (HSRL) to measure aerosol distributions and optical properties. The HSRL technique takes advantage of the spectral distribution of the lidar return signal to discriminate aerosol and molecular signals and thereby measure aerosol extinction and backscatter independently. The LaRC instrument employs the HSRL technique to measure aerosol backscatter and extinction profiles at 532 nm and the standard backscatter lidar technique to measure aerosol backscatter profiles at 1064 nm. Depolarization profiles are measured at both wavelengths. Since March 2006, the airborne HSRL has acquired over 215 flight hours of data deployed on the NASA King Air B200 aircraft during several field experiments. Most of the flights were conducted during two major field experiments. The first major experiment was the joint Megacity Initiative: Local and Global Research Observations (MILAGRO) /Megacity Aerosol Experiment in Mexico City (MAX-MEX)/Intercontinental Chemical Transport Experiment-B (INTEX B) experiment that was conducted during March 2006 to investigate the evolution and transport of pollution from Mexico City. The second major experiment was the Texas Air Quality Study (TEXAQS)/Gulf of Mexico Atmospheric Composition and Climate Study (GoMACCS) that was conducted during August and September 2006 to investigate climate and air quality in the Houston/Gulf of Mexico region. Several flights were also conducted to help validate the Cloud-Aerosol LIdar with Orthogonal Polarization (CALIOP) lidar on board the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite (CALIPSO) satellite. In February 2007, several flights were carried out as part of an Environmental Protection Agency (EPA) experiment to assess air quality in central California. Airborne HSRL data acquired during these missions were used to quantify aerosol extinction and optical thickness contributed by various aerosol types. Several B200 flights conducted during MILAGRO were coordinated with flights carried out by the Department of Energy G-1 aircraft, the National Center for Atmospheric Research (NCAR) C-130 aircraft, and/or the Sky Research J-31 aircraft. In situ measurements of aerosol microphysical properties acquired on G-1 and C-130 are being used to investigate the ability to discern various aerosol types using the HSRL data. Aerosol extinction profiles derived from the in situ measurements and from the NASA Ames Airborne Tracking Sun Photometer on board the J-31 are being used to assess the HSRL aerosol extinction profiles. Additional applications of airborne HSRL data to be discussed include: 1) characterization of the spatial and vertical distributions of aerosols, 2) investigation of aerosol variability near clouds, 3) evaluation of model simulations of aerosol transport, and 4) assessments of aerosol optical properties derived from a combination of surface, airborne, and satellite measurements.