Development and Evaluation of Remote Sensing and In Situ Aerosol Measurement Capability Aboard the NASA Langley King Air Aircraft in the DEVOTE Field Campaign

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DEVOTE (Development and Evaluation of satellite ValidatiOn Tools by Experimenters) develops and demonstrates a new airborne aerosol measurement capability to enable systematic and coordinated flights with remote sensing and in situ instruments on two separate platforms. This capability is developed to evaluate and improve aerosol/cloud retrievals from current satellite instruments like the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) and future aerosol/cloud satellite sensors planned for the Aerosol, Clouds, and Ecosystems (ACE) part of the Earth Science Decadal Survey. The demonstration flights provide measurements of aerosol properties in varying atmospheric and aerosol conditions. Specific flights are performed to study a range of aerosol classifications including fresh anthropogenic pollution, aged pollution, sea salt, and biogenic sources to demonstrate platform capability. The flight profiles also incorporate both ground based AERONET (AErosol RObotic NETwork) overpasses and underpasses of the NASA A-Train providing case study datasets for comparison. As part of DEVOTE, two NASA Langley King Air aircraft have been outfitted with instruments focused on measurements of aerosols. The first of these aircraft is used as a remote sensing platform with the NASA Langley High-Spectral Resolution Lidar (HSRL) and the Research Scanning Polarimeter (RSP). The second aircraft has been modified for use as an in situ aircraft that includes a suite of aerosol optical and microphysical instrumentation, a pair of diode laser hygrometers (DLHs) for water vapor and cloud extinction measurements, and a newly developed polarized imaging nephelometer (PI-Neph). The PI-Neph will provide the first airborne in situ measurements of polarized aerosol phase functions to enable more direct comparisons to the RSP measured radiances and to the phase functions retrieved from AERONET measurements. The remote sensing package has flown in a variety of previous campaigns; however it has only been coordinated with in situ measurements in a limited number of cases. The novel airborne platform enables relatively-low cost and systematic flights that provide datasets useful for the evaluation of aerosol retrievals from remote sensors targeted for use on future satellite missions. In particular, combined retrievals from the polarimeter and lidar are of great interest. An overview of the instrument payloads, aircraft capabilities and flight profiles, together with preliminary measurements results and comparisons from the two aircraft are presented.

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