A new technique for the retrieval of near surface water vapor using DIAL measurements

Syed Ismail[1], Susan Kooi[2], Richard Ferrare[1], David Winker[1], Johnathan Hair[1], Amin Nehrir[1], Anthony Notari[1], and Chris Hostetler[1]
[1]Science Directorate, NASA Langley Research Center, Hampton VA 23681,
[2]SSAI, Inc. Hampton, VA

Water vapor is one of the most important atmospheric trace gas species and influences radiation, climate, cloud formation, surface evaporation, precipitation, storm development, transport, dynamics, and chemistry. For improvements in NWP (numerical weather prediction) and climate studies, global water vapor measurements with higher accuracy and vertical resolution are needed than are currently available. Current satellite sensors are challenged to characterize the content and distribution of water vapor in the Boundary Layer (BL) and particularly near the first few hundred meters above the surface within the BL. These measurements are critically needed to infer surface evaporation rates in cloud formation and climate studies. The NASA Langley Research Center Lidar Atmospheric Sensing Experiment (LASE) system, which uses the Differential Absorption Lidar (DIAL) technique, has demonstrated the capability to provide high quality water vapor measurements in the BL and across the troposphere. A new retrieval technique is investigated to extend these DIAL water vapor measurements to the surface. This method uses signals from both atmospheric backscattering and the strong surface returns (even over low reflectivity oceanic surfaces) using multiple gain channels to cover the large signal dynamic range. Measurements can be made between broken clouds and in presence of optically thin cirrus. Examples of LASE measurements from a variety of conditions encountered during NASA hurricane field experiments over the Atlantic Ocean are presented. Comparisons of retrieved water vapor profiles from LASE near the surface with dropsonde measurements show very good agreement. This presentation also includes a discussion of the feasibility of developing space-based DIAL capability for high resolution water vapor measurements in the BL and above and an assessment of the technology needed for developing this capability.