

## LASE Measurements of Water Vapor, Aerosols, and Clouds During SOLVE

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The Lidar Atmospheric Sensing Experiment (LASE) system was operated from the NASA DC-8 aircraft during the SOLVE field experiment that was conducted over the Arctic region during November 1999-March 2000. LASE measured water vapor, aerosol, and cloud distributions during 24 flights over the northern high latitudes. LASE operated in both nadir and zenith modes simultaneously and, therefore, acquired data to study polar stratospheric clouds (PSCs) as well as to investigate stratosphere-troposphere exchange, atmospheric waves, cirrus clouds, and evaluate POAM water vapor profiles. Initial results of these measurements were made available in real-time to DC-8 investigators to assist in flight planning. Water vapor measurements in regions of tropopause folds indicated dynamical features that were well correlated with potential vorticity fields. The arctic troposphere was generally dry with the highest mixing ratio values reaching the range of 2-3 g/kg in the lower troposphere. Relative humidity profiles derived from LASE water vapor and MTP temperature profiles showed regions of ice supersaturation that were often associated with cirrus clouds. LASE observed PSCs at altitudes between 14-26 km in the Arctic stratosphere. The aerosol scattering ratios associated with these PSCs that were measured by LASE at 815 nm ranged from 0.05 to >200.0 and their locations coincided with PSC observations from the multiwavelength UV DIAL system. LASE observed many examples of atmospheric gravity waves in aerosol scattering ratio fields. These waves were associated with orographic features and were observed over Scandinavia and near the coast of Greenland. These atmospheric waves were correlated with MTP temperature variations and are considered to be a source for the initiation of the PSCs. Cirrus clouds were frequently observed inside the polar vortex with cloud tops reaching an altitude of less than 10 km indicating the low altitude of the polar tropopause. Optically thick cirrus was generally observed during times when the DC-8 crossed regions of the jet stream and tropopause fold events were also generally observed to be associated with jet stream dynamics.

We shall present examples of LASE measurements of PSCs, atmospheric gravity waves and their association with PSCs and MTP temperatures, stratospheric-tropospheric exchange, and cirrus clouds and their relation with relative humidity distributions. Comparisons of LASE water vapor profiles with POAM satellite upper-tropospheric water vapor measurements and with DC-8 cryogenic and laser diode hygrometers will also be presented.