A High Spectral Resolution Lidar for Operation in the Arctic: A Progress Report

E. W. Eloranta, I. A. Razenkov, B. E. Kucia, B. E. Bots, J. P. Habibek, and J. P. Garcia

University of Wisconsin
1223 W. Dayton Street, Madison-Wisconsin 53706, USA
Phone: 608-262-7127 Fax: 608-262-9797 eloranta@lidar.ssec.wisc.edu

The National Aeronautics and Space Administration has funded the construction of a High Spectral Resolution Lidar (HSRL) for long-term unattended operation in the Arctic. The HSRL is one of the final components of the Arctic Monitoring and Assessment Program (AMAP) in the Arctic. The AMAP is a joint effort of the United States, Canada, and Russia to study the impact of human activities on the environment of the Arctic.

The HSRL is a high-spectral-resolution lidar designed to measure aerosol properties at high spectral resolution (in the ultraviolet region). The lidar is capable of measuring aerosol backscatter cross-section, depolarization, and optical depth. The lidar can be operated in a variety of modes, including daytime and nighttime operation.

The lidar is a compact, highly stable system with a range of 100 km. It is designed to be mounted in a temperature-controlled housing to maintain stability over a wide range of environmental conditions. The lidar is capable of operating in a remote location, with minimal maintenance.

The HSRL is a key component of the AMAP program, as it provides calibrated measurements of aerosol backscatter cross-section and optical depth. The lidar is an important tool for studying the impact of human activities on the environment of the Arctic.

The HSRL provides calibrated measurements with known error bars--data samples from the previous system.

The first lidar cross section obtained with the new instrument.

The HSRL provides calibrated measurements of aerosol backscatter cross-section, depolarization, and optical depth. Rigorous error bars can be computed for all quantities. Profiles and error estimates plotted on the right are derived from data obtained between 1:03 and 1:08 UT.

Profiles with error estimates are plotted in the right hand panels. Terms contributing to the errors are plotted in the left panels. Errors due to limitations in our knowledge of the molecular density profiles are labeled "un-determined." Errors due to calibration uncertainties are labeled "Calibrated," and errors due to statistical fluctuations in the number of photons counted are labeled "Photon Counting."