GROUND BASED LIDAR CHARACTERIZATION OF CIRRUS CLOUDS

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The optical properties and spatial coverage of cirrus clouds must be known for climate prediction. Lidar is capable of detecting tenuous cirrus clouds. Lidar is also able to make measurements through all except the thickest cirrus clouds. Traditional lidar systems provide insufficient information to allow unambiguous measurement of optical depth or backscatter cross sections. Furthermore, cirrus often includes structures which are elongated in the direction of the wind; this makes it difficult to estimate the area-averaged cloud coverage from temporally-averaged profiles measured with a vertically pointed lidar. These two problems are addressed with unique lidar systems developed at the University of Wisconsin.

The Volume Imaging Lidar (VIL) provides rapid high spatial resolution imaging of cirrus clouds. Typical images depict structure along a 120 km slice of the atmosphere with a 60 m spatial resolution. These images, which are recorded at a rate of two per minute, allow calculation of true spatial averages. The High Spectral Resolution Lidar (HSRL) divides aerosol and molecular scattering into separate profiles; the additional information provides absolutely calibrated measurements of optical depth, backscatter cross section, backscatter phase function and depolarization. Multiple scattering measurements are also recorded with the HSRL; these provide information on the size of cloud particles.

This paper presents cirrus cloud observations made with the HSRL and the VIL. The HSRL has been redesigned to use an iodine absorption filter in place of the Fabry-Perot etalon which was used for spectral separation of the aerosol and molecular lidar returns. These modifications, which improve both sensitivity and calibration stability, are described.