HYDROMETEOR LINEAR DEPOLARIZATION RATIOS

K. Sassen
Department of Atmospheric Resources, University of Wyoming
Laramie, Wyoming 82070, U. S. A.

ABSTRACT

A summary is presented of the results of laboratory cloud scattering measurements and of field measurements performed on natural and seeded orographic cap cloud crystals and precipitation-sized hydrometeors. All measurements have been taken in the backscatter with a helium-neon laser source and a receiver which measures the parallel and cross-polarized signal components simultaneously.

The initial laboratory data (taken as a function of laser-receiver elevation angle to ensure applicability to lidar results) has demonstrated the feasibility of remotely determining liquid to ice particle concentration ratios from lidar linear depolarization ratios and has also indicated a considerable difference in the scattering behavior of individual 25 to 150 plate crystals from that of similarly sized columnar crystals. The extent to which it is possible to differentiate ice crystal structure on the basis of the linear depolarization ratios produced from single particle scattering interactions is presently being investigated. So far, several distinct ice crystal species have been interrogated in the field and found to possess characteristic pulsed signal signatures. The effect of particle orientation and size on signal pulses will be investigated shortly under controlled laboratory conditions. Measurements will continue to be taken in the presence of cloud droplet populations utilizing extended scattering volumes.

The value of these results in lidar data interpretation is discussed. Lidar design specifications are suggested which would enable laser radar techniques to significantly increase the output of the type of cloud microphysical data of particular concern to cloud modification efforts.