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DETERMINATION OF CLOUD MICROPHYSICAL PROPERTIES
BY LASER BACKSCATTERING AND EXTINCTION MEASUREMENTS

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ABSTRACT

The extinction and backscattering of 514nm laser radiation in poly-disperse water droplet clouds has been studied in the laboratory. Three cloud size distributions with modal diameters of 0.02 μ m, 5 μ m and 12 μ m have been investigated. The relationships between the cloud optical parameters (attenuation coefficient, σ and volume backscattering coefficient, β_{π}) and the cloud water content, C, have been measured for each size distribution. It has been found that a linear relationship exists between σ and C and between β_{π} and C for cloud water content values up to 3 gm/m³. The linear relationships obtained, however, have slopes which depend on the droplet size distribution. For a given water content both σ and β_{π} increase as the modal diameter decreases. The measured data are compared with existing theoretical analyses and discussed in terms of their application to lidar measurements of atmospheric clouds. It is concluded that the empirical information obtained can serve as a basis for quantitative lidar measurements.