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 polydisperse water droplet clouds has been studied in the laboratory. Three cloud size distributions with modal diameters of 0.02μm, 5μm and 12μm have been investigated. The relationships between the cloud optical parameters (attentuation 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/m^3. 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.