COMPARISONS OF AEROSOL STUDIES PERFORMED FROM BELOW AND ABOVE THE ATMOSPHERE

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ABSTRACT

Ground based monostatic lidar experiments are subject to scale setting problems on account of scattering by relatively dense low altitude aerosols. In addition, there is also the possibility that radiation subject to multiple scattering at low altitudes might affect the return from higher altitudes. The work presented here was carried out to determine the extent to which these problems might be alleviated by satellite or aircraft borne systems.

The study was based on a Monte Carlo radiative transfer model with polarization represented by four-parameter Stokes vectors. Mueller matrix transformations were applied at each scattering and analytical integration of the radiative transfer equations over one scattering employed for photon sampling. Both the impulse source time resolved monostatic experiment and the steady state sky brightness experiments were treated.

The model atmosphere was comprised of horizontal layers of Rayleigh and aerosol scatterers. An Elterman type vertical aerosol density was assumed. For the scattering matrix elements we tried both the experimental results of Holland and the Mie theory results for spherical particles with the same diameter distribution as those investigated experimentally.

The results indicate a considerable improvement for the lidar system above the atmosphere and that constraints on the telescope field of view can be relaxed for night-time operation. The downward looking steady state Stokes parameters measured above the atmosphere could provide supplementary information for discriminating between spherical and non-spherical particles.