THE POINT VISIBILITY METER - A FORWARD SCATTER INSTRUMENT FOR THE MEASUREMENT OF AEROSOL EXTINCTION COEFFICIENT

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ABSTRACT

A forward scatter instrument for the measurement of the atmospheric extinction coefficient has been developed by the Electro Optics Group of Plessey Radar. The instrument is termed a "Point Visibility Meter" (P. V. M.) and is capable of measuring the atmospheric extinction coefficient over the range .075 km^{-1} to 60 km^{-1}. This corresponds to a Meteorological Visual Range of 40 km to 50 m; (assuming the W. M. O. accepted minimum discernible contrast of 5%). Over this range of visibilities, the output of the device is proportional to the atmospheric extinction coefficient.

Both theoretical and experimental studies have been undertaken to support the P. V. M. development programme. The angular scattering functions, normalised against extinction coefficient, and plotted against scatter angle are shown in figure 1. The different curves result from variations in fog particle size distributions. However, it can be seen that there is a particular angle for which $\underline{\beta(\theta)}$ is substantially constant.

i. e. $\sigma = K\beta(\theta)$

where $\beta(\theta)$ is the cross section at angle θ

K is a constant

The total atmospheric extinction coefficient is made up of two components:

$\sigma_T = \sigma_S = \sigma_A$

where σ_S is the scattering extinction coefficient

σ_A is the absorption extinction coefficient

however for water fogs in the wavelength region of interest, the σ_A

contribution may be neglected.

The Point Visibility Meter gives an output which is a measure of the light scattered at the particular angle ( ). This quantity has been shown to be directly proportional to the atmospheric extinction coefficient, to within the $\pm$10% accuracy of the instrument.

Theoretical evidence to support this forward scattering technique will be presented, together with results from trials in natural and artificial fogs.

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