

PROPAGATION OF FINITE WIDTH LIGHT BEAMS THROUGH EARTH'S ATMOSPHERE

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ABSTRACT

In recent years there has been increased interest in the two- and three-dimensional radiative-transfer problem. It is realized that the scattering and absorbing properties of the atmosphere depend upon the horizontal direction as well as the vertical direction and therefore any serious study of the radiation field must take this into account. Mathematically, a similar analysis can be carried out for the propagation of beams of radiation through the atmosphere. The origin of the beam is at some point in the X-Y plane at the top of the atmosphere, thus simulating a laser beam originating from a satellite or spacecraft. The cross section of the beam has an arbitrary intensity distribution, and the scattered radiation field resulting from the propagation of the beam through the atmosphere is calculated in terms of various optical parameters such as optical thickness and single-scattering albedo.

The resulting analysis shows that the diffuse radiation field as well as the attenuated laser beam radiation can be calculated for a variety of atmospheric states. Since the calculations depend upon the width of the beam, the results of this analysis can be applied to the practical problems associated with future large scale laser beam propagation from satellites and spacecraft.