CREDIBILITY AND SIGNIFICANCE OF LIDAR OBSERVATIONS OF THE STRATOSPHERIC AEROSOL

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ABSTRACT

For approximately the past two and one-half years, the U.S. Department of Transportation's Climatic Impact Assessment Program (CIAP) has been supporting several lidar investigations in order to obtain data on the natural variability (spatial and temporal) of the stratospheric aerosol. While all of these observations have been based on the same basic principles and techniques, the complete treatment of raw measurement data is not standardized. Conversion of the lidar-measured optical data to more familiar physical parameters involves certain assumptions and transformations, which may differ among various research groups. These include the determination of a "molecular" reference layer (both its existence and its location), the selection of molecular density and particulate extinction profiles, and the use of a particulate optical model for optical-to-physical conversions. The validity of these assumptions and transformations is investigated, primarily by reference to other stratospheric measurements, especially those made in conjunction with lidar observations. By this means the strengths and weaknesses of the lidar technique are assessed with respect to specific observational goals in the stratosphere, including the validation of dynamic and photochemical models.

In the light of these strengths and weaknesses, the significance of the CIAP lidar measurements is assessed, both in the context of previous stratospheric lidar observations, and with reference to the assessment of probable stratospheric changes induced by aerospace activity. Extensions of present measurement and analysis methods will be suggested to enhance the utility of lidar observations in future stratospheric monitoring programs.