RESULTS FROM THE SRI-CIAP STRATOSPHERIC LIDAR OBSERVATION PROGRAM*

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ABSTRACT

During the period November 1972 through April 1974, SRI made periodic lidar observations of the stratospheric aerosol as a part of the Climatic Impact Assessment Program. Using a ground-based ruby lidar, vertical profiles of lidar scattering ratio and particulate backscattering coefficient were obtained by reference to an assumed molecular layer. The profiles revealed a quasi-permanent aerosol layer (the "Junge" layer) of ~ 6 km thickness centered near 21 km, with occasional appearances of particulate content above and below this major peak layer. As in other CIAP-sponsored lidar observations, the maximum particulate backscattering coefficient was only 10 to 20% of the molecular backscattering coefficient, indicating a substantial decrease with respect to lidar observations closely following the 1963 Agung volcanic eruption. A level of relative minimum in scattering ratio was usually observed between 10 and 15 km.

The regions above and below the major or Junge layer exhibited monthly variations in particulate backscattering which exceeded the variations in the major layer. A sudden decrease in particulate backscattering between 22.5 and 27.5 km was observed in late January 1973, coinciding with a sudden

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stratospheric warming and the associated reversal of the local zonal wind. The end of the stratospheric warming and the resumption of normal zonal flow were accompanied by a return to higher particulate backscattering in this layer.

In July 1973 a comparative experiment including aircraft collection of a stratospheric particulate sample at 18.7 km was conducted. Good agreement between lidar- and aircraft-inferred particulate mass concentration was obtained by using an optical model of the sampled particles which is consistent with laboratory analysis of the aircraft sample and other CIAP-sponsored measurements. This same model was then used to convert the complete series of particulate backscattering measurements to stratospheric particulate optical thicknesses in various layers. The resulting optical thicknesses are about an order of magnitude smaller than those obtained by searchlight measurements made in 1964 and 1965. The implied temporal decline in particulate optical thickness is in accord with the corresponding decline in lidar-observed backscattering coefficient, and is most probably associated with reduced volcanic intrusions of the stratosphere, as noted by a number of other investigators using several measurement methods.