ROCKET TEMPERATURE SOUNDINGS

by

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In situ rocket-borne measurements of temperature and wind contribute to a better determination and understanding of stratospheric behavior and, hence, to a better understanding of processes that control the dynamical and chemical behavior of this region. Rocket-borne measurements provide basic data for satellite validation and calibration over the short- and long-term, and for evaluation of new ground-based systems, such as lidar. Rocketsonde measurements are used for definitive, small-scale studies of atmospheric behavior and permit monitoring of changes occurring in the stratosphere. This long-term data set is of extreme value for depicting temperature trends and for their correlation with possible trends in the Earth's ozone shield. During 1986 and 1987, meteorological rocketsonde funding was only sufficient to permit a minimum number of launchings consistent with maintaining launch range expertise and capability.

Concern over ozone depletion and the difficulty generally involved in determining actual ozone trends has generated significant interest in temperature behavior, especially trends. Recent analysis of rocketsonde acquired temperature data between 1969 and 1986 contains evidence that the stratosphere may indeed be cooling. Preparation of material for contribution in the

Report of the Temperature Trends Committee estimates that this cooling trend is -0.2/0.3°C per year. Because the magnitude of this change is small compared to the magnitude of the measurement, the measurement system must possess the capability to provide high resolution. The precision of the present rocketsonde instrument is about 0.6/0.9°C for temperature and about 200-300 meters in the vertical between 20 and 55 kilometers; this presently is better than the resolution of any other instrument providing stratospheric measurement data. While radiosondes provide more frequent measurements, their altitude is limited to below 30 kilometers.

A lidar for measuring density (temperature) between 25 and 100 kilometers (current capability is about 25 to 80 kilometers) under development at the Air Force Geophysics Laboratory was compared to meteorological rocketsonde measurements. This comparison took place at the Wallops Flight Facility (1985) and at the Poker Flat Research Range, Alaska (1986). The tests were successful; the comparison showed that substantial agreement exists between this lidar and the in situ data. As a result of these comparisons, lidar design improvements are expected. The lidar Principal Investigator has since moved to The Pennsylvania State University and plans to continue the development of a stratospheric-mesospheric lidar. New comparisons are being considered.

It is the intention of the RTOP to continue to provide

rocketsonde measurements to: 1) maintain the long-term data stratospheric-mesospheric data base already established for Wallops; 2) provide ground truth for remote measurements; and 3) continue studies of atmospheric structure and morphology of disturbances and anomalous events as resources permit.