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MEASUREMENTS OF OZONE IN THE ANTARCTIC REGION DURING AUGUST AND SEPTEMBER OF 1987

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Mixing ratios are presented for ozone in the austral polar atmosphere during August and September of 1987. Since the mid-1970's, there has been a continuing decrease in the total column abundance of ozone over Antarctica during the late winter and early spring. This reduction now amounts to about one-half of the historical October mean. The recent discovery of this phenomenon has stimulated several theoretical and experimental efforts to understand the mechanisms responsible for the reduction. The results presented here are derived from an ultraviolet ozone photometer designed and built by NASA Ames Research Center and installed on NASA's multi-instrumented, high-altitude ER-2 aircraft. This aircraft carrying 14 instruments participated in a major effort to penetrate the region of depletion. Data were gathered between latitudes of 53° and 72° south at pressure altitudes (U.S. Standard Atmoshere) up to 21 km in a series of 12 flights from Punta Arenas, Chile, over the Palmer Peninsula. Additional data were obtained between latitudes of 37° north and 53° south on the 3 flight legs required to reach Punta Arenas from Moffett Field, California, and on the same return legs to Moffett Field. The photometer is located on the aft section of the main instrument bay of the aircraft. The air inlet probe protrudes into the airstream at a location on the right side of the aircraft close to the instrument. The sampled airflow is driven by the dynamic pressure generated by the aircraft's motion and is vented just aft of the inlet. The information required for the calculation of the mixing ratio for ozone is stored in battery backed RAM each second throughout a flight. The pressure altitude, total air temperature, and Mach number are also recorded by this instrument. A typical flight profile consisted of a southbound path on the 428° K potential temperature surface, a descent to a pressure altitude of 13.7 km, a climb to 460° K surface, and return on this surface. The mixing ratios for ozone at pressure altitudes above 15 km in the southern part of the flights were significantly lower than values outside the polar vortex. The observed ozone mixing ratios indicate the effects of chemistry as well as the effects of the stratospheric polar vortex. Examples of the distributions of ozone mixing ratios as a function of altitude, latitude, or time and the relationships to temperature and other trace gases are presented.