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CORRELATIVE MEASUREMENTS PROGRAM

by

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1987 can legitimately be called the year that ozone trend detection became a public issue in the U. S. In the Fall of 1986, an interagency Antarctic Ozone Expedition Team, known as the National Ozone Expedition (NOZE), spent the months of August-November in Antarctica. They conducted a coordinated series of ground- and balloon-based observations to study the disappearance of stratospheric ozone reported by Farman et al. of the British Antarctic Survey. The NOZE results verified the report that the ozone level was diminished by as much as 90 percent at some altitudes and that the reduction increased every year. At the same time, unpublished reports were circulated stating that the ozone amounts around the entire globe were decreasing at the rate of about 1 percent per year. It is known that an ozone decrease can be associated with an increased risk of skin cancer in humans. Consequently, the Antarctic and global results heightened interest in ozone trend detection. In the Fall of 1986, NASA, in conjunction with the World Meteorological Organization and the United Nations Environment Program, initiated a major review on the subject of ozone trend detection with a report on the findings due by the end of 1987.

An Ozone Trends Panel, composed of eminent scientists from federal agencies, industry, and universities, was formed.

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Chaired by Dr. R. Watson of the Upper Atmosphere Programs Office of NASA Headquarters, the Panel contains Calibrations, Algorithms, Satellite/Satellite Intercomparisons, Satellite/Ground Intercomparisons, Comparison of Theory and Observations, Other Trends in Stratosphere, Source Gases, Aerosols, Antarctic Ozone, and Temperature Working Groups. The GSFC Correlative Measurements Program (UPN 665-70) at the Wallops Flight Facility was represented on the Satellite/Satellite Intercomparisons Working Group. The Correlative Measurements Program uses the Rocket Ozonesonde (ROCOZ-A) and the Electrochemical Concentration Cell (ECC) balloon-borne ozonesonde to measure the vertical profile of ozone amount in the atmosphere. The balloon work is described in a separate report in this volume entitled "Ozone Measurements Using Balloon-Borne Ozonesondes," by Arnold L. Torres. The ROCOZ-A instrument has been used for many years to provide in situ "truth" data for various satellite ozone measuring systems, such as SBUV on Nimbus-7, SAGE-II, SBUV-II on the NOAA series of polar orbiting satellites, SME, LIMS, etc. The particular data sets of interest to the Ozone Trends Panel Working Group were collected at Natal, Brazil.

During an experiment at Natal in March and April of 1985, it was found (Barnes, et al., "Equatorial Ozone Profiles From the Ground to 52 km During the Southern Hemisphere Autumn," Journal of Geophysical Research, Vol. 92, No. D5, May 20, 1987, pp. 5573-5583) that the atmospheric variability is negligible. Therefore,

a small number of ROCOZ-A vertical ozone profiles can be compared with high precision with a larger number of satellite ozone profiles in that area and in the same time frame without requiring time coincidence. This reduces the cost of the field experiment and reduces the complexity of the launch schedule. This makes the Natal area in March and April an ideal location to use the rocket profiles to tie together various satellite instruments.

The major results produced for and used by the Ozone Trends Panel are shown in figure 1. The ROCOZ-A average ozone density profile is plotted versus altitude on the left. ECC ozonesondes were used for the portion of the profile below 20 km, the lower limit for ROCOZ-A. In the center graph, the difference between SAGE-II and ROCOZ-A average density profiles is shown. Between 25 and 50 km, the differences are sometimes negative and sometimes positive, they never exceed 5 percent, and average about -1 percent (ROCOZ-A on average is slightly higher). In the right-hand graph, the difference between ROCOZ-A and the SBUV results from Nimbus-7 are plotted. This comparison is made in terms of ozone layer amount versus Umkehr layer, the primary ozone data product from the SBUV. For all layers, the differences are all negative. That is, the SBUV values are less than ROCOZ-A. The difference is 18 percent at layer 9 and 5 percent at layer 6. This result is discussed in further detail by Barnes ("Changes in SBUV Ozone Profiles Near Natal, Brazil, from 1979 to 1985," Journal of Geophysical Research, Vol. 93, No. D2, February 20, 1988, pp. 1704-1717).

The implication of the Natal data sets and the analyses by Dr. Barnes (Chemal, Inc.) resulting from them is that the SBUV vertical profile shape is inconsistent with atmospheric behavior. Instrumental effects in the SBUV that are improperly accounted for in the Nimbus-7 data processing may be responsible. The recently published report by the Ozone Trends Panel does indeed indicate that findings from the other Working Groups agree with ours. The report does conclude that an ozone decrease on a global scale is real, however. Although the earlier reports of a decrease were considerably exaggerated because of the SBUV instrument problem, the Earth's ozone amount is decreasing. In the future, even more attention will be paid to the close monitoring of the global trend. We expect that the ROCOZ-A measurement will continue to be of importance in this effort.

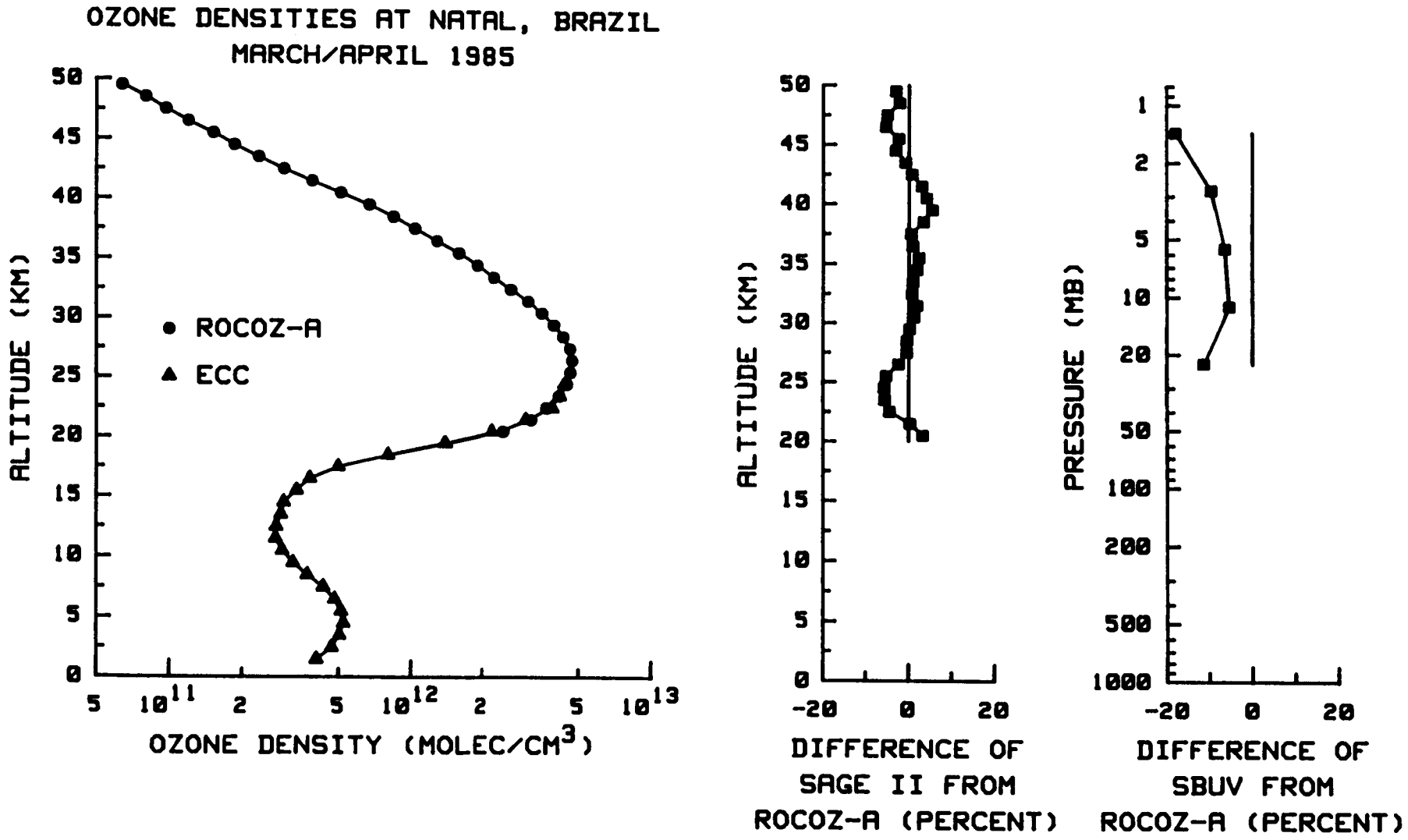

Figure 1. The ROCOZ-A Average