ture decreases associated with simultaneous increase of carbon monoxide and decrease of ozone. Again no such feature was observed in the Antarctic measurement only showing approximately a constant level of carbon monoxide concentration irrespective of ozone variations.

According to the investigation of the present author a big geomagnetic storm took place immediately before the starting of the Arctic measurement. On the basis of the fact that the binding energy of polyatomic molecules is generally weaker than diatomic molecules in the atmosphere and the electron bombardment has easier access to molecules for excitation and dissociation than photons in low energy regions, the author assumed a scenario of intervening mechanisms as follows: The auroral X-rays penetrated down to the lower stratosphere during magnetic storms, then producing photoelectrons. The electrons in the course of losing energy by collision with air molecules dissociated CO_2, thus producing CO. The decrease of CO_2 and O_3 in the upper layers will give rise to the temperature decrease of lower layers by way of radiational cooling to space.

The main point of discussion in this paper is the quantitative explanation of the amount of CO increase at the level of observation which is usually supposed to be too low for X-rays to arrive. Population of CO_2 dissociation was calculated by means of the analytical expression of the yield of secondary electrons deduced by A. E. S. GREEN *et al.* (J. Geophys. Res., **82**, 5101, 1977) and the dissociation cross section of CO_2 reported by J. L. FOX and A. DALGARNO (Planet. Space Sci., **27**, 491, 1979). Then the number density was calculated with the assumption of the amount of electron precipitation as was considered reasonable from observation. The result turned out to be too small almost by the order more than three. In order that this mechanism works well some kind of amplification is needed. A promising physical mechanism is the intervention of electric field associated with the geomagnetic storm. This will energize the electrons of the whole steps of degradation, thus increasing the number of the slowest electrons by many orders which are essentially supposed to play a main role for the dissociation of polyatomic molecules.

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SPECTRAL MEASUREMENTS OF THE SOLAR RADIATION AT SYOWA STATION, ANTARCTICA (ABSTRACT)

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Spectral measurements of the solar radiation were performed at Syowa Station, Antarctica, from January 1984 to January 1985 as part of the Antarctic Middle Atmosphere Program by one of the authors (M.S.) as a wintering member of the 25th Japanese Antarctic Research Expedition.

The spectral intensity of direct solar radiation was measured by a sunphotometer (Eko Instruments Co., Model MS-111) which was equipped with eight interference filters at wavelengths λ = 332, 369, 500, 675, 777, 862, 939 and 1048 nm. Values of the aerosol optical thickness obtained by this sunphotometry were larger than

those measured previously by several investigators in the antarctic region. The aerosol optical thickness at $\lambda=500$ nm was about 0.08 as an average of the observed values for the period from January to April 1984, while it decreased to about 0.04 for the period from September 1984 to January 1985.

Angular distributions of the scattered radiation in the solar aureole region were measured by an aureolemeter, *i.e.* a wide-dynamic-range scanning radiometer with filters of the same wavelengths as the sunphotometer. The instrument is designed to be able to measure direct-solar and scattered sky radiances simultaneously in all directions. We found that the diffuse-to-direct radiation ratio in the solar almucantar divided by the optical airmass, which is approximately proportional to the optical thickness determined by the sunphotometry, also decreased in the summer of 1985 to about one half of the value in the summer of 1984.

Volume spectra of columnar aerosols were obtained by inverting the spectral extinction data and the solar aureole data simultaneously. It was found that the mono-modal volume spectrum with mode radius of about 0.4 μm was dominant throughout the year and that the loading of giant particles ($r>1$ μm) was enhanced relatively in autumn and spring.

Measurements of the sky brightness distribution were carried out for the period from August 1984 to January 1985. Comparisons between observed and calculated distributions of the brightness and the degree of polarization in the solar principal plane showed that the representative value of the surface albedo around Syowa Station was about 0.8 in early summer, and about 0.7 in midsummer.

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BALLOON MEASUREMENT OF AEROSOLS IN THE ANTARCTIC STRATOSPHERE (II) (ABSTRACT)

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A balloon measurement of aerosols has been made in the summer of 1984 to investigate the behavior of the polar stratospheric aerosols. Number concentration and the size distribution of Mie particle (aerosol particles with diameter greater than 0.3 μm) were measured by using a light scattering aerosol particle counter. The counter has two pulse height discriminators to differentiate the size of the particles having the diameter greater than 0.3 and 0.5 μm, respectively, for the refractive index of 1.40. A rough indication of the size distribution is obtained from the size ratio.

The vertical distribution of the number concentration and the size distribution were obtained up to about 13 km on December 18, 1984. Compared with the result of the measurements on June 3 and October 16, 1983, the present result indicates the low concentration at stratospheric heights. This shows that the seasonal variation of aerosol concentration exists clearly in the antarctic stratosphere. The concentration was found to be slightly higher than that usually appeared during the low volcanic period in the summer season. This indicates that the aftereffect of El Chichón eruption still remains in the antarctic stratosphere. The aerosol count ratio of two size ranges shows small values in the stratosphere.