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## Section 2. Sources of Atmospheric and Atmospheric Electricity

In 1983 this section has made its effort mainly to participate in the Middle Atmosphere Program (MAP) which is an international scientific cooperation program to approach to the general understandings of the stratosphere and the mesosphere.

The laser radar constructed in spring of 1982 has entered from the end of 1982 into regular base observation of stratospheric aerosols by using the wavelength of 532 nm, the second harmonic of YAG laser. In December 1982 when the reliable aerosol profile has begun to be obtained, the effect of El Chichon volcano which erupted in March to April 1982 was still outstanding and the maximum back scattering ratio was about 10. Since then the observations have been made in almost every fair-weather night. During this year the back scattering ratio has come down to about 2 and the altitude of maximum aerosol density also down from 22 km to 17 km. Detailed analysis on the variations of aerosol layer is being made on the basis of the frequent observations.

MAP aircraft observations by Merlin IV from Yao airport were carried out in cooperation with several universities and institutes on February 18 and 20, respectively on the routes to Miyazaki and to Akita. The flight to Akita passed partly above the tropopause and supplied us important data to explain the exchange process between the troposphere and the stratosphere. Aircraft observations were also made independently with other research groups on March 9 over the Pacific Ocean 300 km away south of Kii Peninsula by Cessna 404 from Nagoya airport. We have measured in these observations the densities of nitrogen oxides and aerosols. The density of NO was 40-90 ppt and that of NO<sub>x</sub> (=NO+NO<sub>2</sub>) was 70-500 ppt in the altitudes of 2-8 km. Variations in the densities seem due to the distance from the polluted land and also partly to possible diurnal variations. The existence of NO<sub>x</sub> of these density values suggests the importance of it in origination of the upper-tropospheric ozone. Accumulation of reliable measurements is now necessary under various meteorological and geographical conditions.

As to the density of aerosols larger than  $0.3 \mu\text{m}$  in diameter, the observations showed in some cases the monotonous decrease up to 8 km from the ground level and in some other cases the minimum density level of about  $0.2 \text{ cm}^{-3}$  at around 6 km altitude. These differences possibly relate to the height of tropopause.

Our first balloon observation of nitric oxide (NO) in the stratosphere was carried out by Y. Kondo on September 20 at Aire-sur-l'Adour, France ( $44^{\circ}\text{N}$ ,  $0^{\circ}\text{W}$ ). This was a part of the first experiment of MAP GLOBUS (Global Budget of Stratospheric Trace Constituents) Campaign. Our mission was a complete success with NO-sonde measurements made up to 32 km in altitude. NO density was 0.25 ppb at the tropopause (12 km) and increased with increasing height to 10 ppb at 32 km level. The sonde was recovered without any serious damage and provided for the next experiment.

The balloon use apparatuses prepared by us to measure the ionization and aerosol density were carried to Syowa Station, Antarctica by the 23rd, 24th, and 25th Japanese Antarctic Research Expedition Parties. Until now 1 flight for ionization and 3 flights for aerosols were made with success. The results in these flights will give us new information on the stratospheric state in polar regions.

EXOS-C satellite was completely equipped through every kind of test in 1983 and launched on February 14, 1984 on schedule from Kagoshima Space Center, Institute of Space and Astronautical Science. We are going to observe by this satellite the global distribution of aerosols and ozone in the stratosphere by using the solar occultation measurements at 1000 and 600 nm wavelength. Ground-based and/or in situ aircraft or balloon observations will also be a help to obtain the ground truth for the satellite mission.

The measurements of atmospheric electricity at Sakushima Observatory which have started in April 1971 has now covered one solar cycle. Some data were analysed in connection with the long and short period variations in the solar activity.

Y. Morita visited the University of Wyoming, U. S. A. for 3 weeks in summer to investigate the stratospheric aerosols and to discuss the further cooperation in this field. Y. Kondo attended the MAP GLOBUS Campaign in France as described above.

25 February, 1984  
- Masumi Takagi -

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