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Section 2. Sources of Atmospherics and Atmospheric Electricity

The MAP (Middle Atmosphere Program) has advanced the third year in 1984. The studies in this section were mainly concentrated in participating in this program. Some of our results were reported at International MAP Symposium at Kyoto on November 26-30, 1984.

The laser radar was in continuous operation to observe the aerosol profile up to 35 km at the wavelength of 532 nm, the second harmonic of Nd:YAG laser. It was confirmed that the stratospheric dust event originated in El Chichon eruption in April 1982 gradually decayed in 1984 toward the background aerosol level in the stratosphere.

The improvement of the lidar system to observe the stratospheric ozone by the method of differential absorption in a UV region was made and being prepared for regular ozone observations in the near future.

Two series of aircraft observations were made for the densities of aerosols and nitrogen oxides in the altitude range up to 8 km. The MAP observations on board Merlin IV aircraft in cooperation with several universities and institutes were made on February 14 and 16 on the routes, Yao-Akita-Okatama-Yao and Yao-29°N, respectively, and on August 7 and 8 on the route from Yao to a point at 19°N via Hachijo-jima and Iwo-jima. The observations on board Cessna 404 were made independently with other research groups on January 12, March 22, and May 8 from Nagoya to 300 km south over the Pacific Ocean. The results of these observations are summarized as follows. In the winter flight toward north the aircraft could sometimes enter the stratospheric air at altitudes beyond 7 or 8 km. Comparing with the results obtained in 1983, the density ratio between two sizes of stratospheric aerosols of diameters larger than 0.3 μm and 0.5 μm decreased from about 30 in February 1983 to 5-6 in February 1984. This suggests that the strong aftereffect of El Chichon eruption had returned to the background state. For the mixing ratio of nitrogen oxides ($NO_x = NO + NO_2$), it was remarked that in winter the northern side of Japan had about 2 times denser concentrations than the Pacific side. In summer at 3-5 km altitudes NO_x density tended to decrease with descending latitude

toward south. The NO_x mixing ratio was about 100 pptV at 30°N and 60 pptV at 19°N, while NO was almost constant value of 20-40 pptV without any remarkable variation. In May the NO density above the Pacific at 30°N showed the lowest value of 10-20 pptV. These informations are still, so to speak, too fragmentary. The reliable data shall be accumulated in the course of MAP and succeeding researches.

The balloon experiment this year was carried out in China by the cooperation of Nagoya University and the Institute of Atmospheric Physics, Academia Sinica. Two members from this section, M. Takagi and A. Iwata, were a party to the balloon campaign. Two balloons were launched from Xianghe Observatory, 60 km ESE of Beijing, on August 18 (50,000 m^3 capacity plastic balloon) and August 23 (30,000 m^3). The items of measurement were the densities of nitric monoxide, ozone, and aerosols in two size ranges. The main gondra of about 155 kg weight was manufactured in this section and sent to China for the campaign. All fascilities for the experiment including balloons, telemeter, command, meteorological sonde etc. were supplied by Academia Sinica. The launching of balloons was excellent. The two flights had roughly similar traces. The balloons reached to the ceiling altitude of 33 km after 2 hours ascent. Then after 1 to 2 hours level flight at the ceiling altitude, just before entering above the city of Beijing, the payload was cut off from the balloon, descended with a parachute, and recovered without any serious damage. The first flight failed to have good data because the telemeter did not work well from superheating. In the second flight we obtained good results for ozone and aerosols, but not for nitric monoxide probably due to unexpected troubles of dry ice which was used as cryogen to cool the detector photomultiplier tube. The density of stratospheric aerosols showed a considerably high value of 10 cm^{-3} for the size range larger than 0.3 μm.

The EXOS-C satellite was launched on February 14, 1984 from Kagoshima Space Center, Institute of Space and Astronautical Science, and named as "Ohzora". The altitudes of apogee and perigee, inclination, and period were respectively 865 km, 354 km, 74.6°, and 96.9 min. The payload called ALA (Aerosol Limb Absorption) are now observing the global distribution of stratospheric aerosols and ozone at the wavelengths of 0.6 and 1 μm. Ground-based lidar and in situ aircraft and balloon observations of these elements are also a help for the ground truth of satellite measurement. The results are being analyzed.

The measurements of atmospheric electricity at Sakushima Observatory was continued to run after the secular variation of several elements. Some data were analyzed in connection with the long and

short period variations in the solar activity, and reported at the Seventh International Conference on Atmospheric Electricity held at Albany, New York on June 4-8, 1984. M. Takagi attended this conference and discussed about the recent problems and the international cooperation in the field of atmospheric electricity.

Y. Kondo attended Quadrennial Ozone Symposium at Halkidiki, Greece on September 3-7, 1984 and reported the measurement of nitrogen oxides.

February 20, 1985
- Masumi Takagi -

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