

Section 2. Sources of Atmospheric and Atmospheric Electricity

Research activities in 1985 are mainly concerned with the MAP (Middle Atmosphere Program) which has continued from 1982 to 1985.

The satellite observation of stratospheric aerosol and ozone has been continuously made with the payload ALA (Aerosol Limb Absorption) on board "Ohzora" since its launching on February 14, 1984. The observation is based on the measurement of solar occultation in the earth's limb atmosphere at wavelengths of 0.6 and 1 μm . The data obtained with the on board photometer, when the satellite comes across sunset or sunrise, are converted to the vertical profile of extinction due to aerosol or ozone at around the tangential position of solar ray path. The observation during the two years covers almost entire globe, from which we deduce the spatial distribution and time variation of these substances in the global scale.

The MAP GLOBUS (Global Budget of Stratospheric Trace Constituents) balloon campaign was carried out at Aire sur l'Adour, France (44°N , 0°W) in fall 1985. The main object of this campaign was to observe nitrogen oxide species as many as possible and their behavior throughout the day. Two members from this section, Y. Kondo and N. Toriyama, attended the campaign to measure the densities of NO and NO₂ in the altitudes up to 34 km. Our measurements were made in two balloon flights on September 19 and October 4. The principle of measurement is the in situ chemiluminescent detection of NO in sampled air. The similar measurement to this was made in the previous GLOBUS campaign at the same place in the same season just two years ago. Comparing the result this time with the previous one, the density of NO in the stratosphere upper than 20 km shows the increase by the factor of about 50 to 80 %, though the cause of the difference is uncertain. Another feature of this year is the existence of an NO layer of 2 km in thickness just below the tropopause. The observation also involves good results of diurnal variation of stratospheric NO.

The aircraft observations of aerosol, nitrogen oxides, and ozone were made in two series. On March 12 and 16, Cessna 404 aircraft took the course Nagoya-Hachijo- 24°N -Hachijo-Nagoya. On December 16 and 17,

the similar observation was made using Merlin IV aircraft in the course of Yao-Hachijo-28°N-Hachijo and Hachijo-38°N-Yao. The southern course was for the observation of the effect of varying distance from the main island of Japan and the northern course was to see the variations in the air flowing across Japan Islands from Japan Sea to the Pacific Ocean. The data accumulated during 4 years of MAP aircraft observations are being analyzed. Generally those substances probably associated with human activities are more abundant in northern area. The condition of decreasing toward south, however, is considerably different with the case of observation.

A new type of ozonometer for aircraft use was developed and trially used in the latter series of observation. The measurement principle is the detection of chemiluminescence of the ozone-ethylene reaction. Main effort was made to maintain the sensitivity constant against the very wide change in pressure and temperature of ambient atmosphere.

The laser radar was in continuous operation at the wavelength of 532 nm since its set up on December 1982. The stratospheric aerosol state in 1985 was still somewhat higher than the background level, but the aftereffect of El Chichon event has almost disappeared. According as the decay of enhanced aerosol aftereffect a seasonal trend became clear. The aerosol content in the stratosphere in winter is about 50 % higher than in summer. The effect of Mt. Ruiz, Colombia (5°N, 75°W) erupted in November was found first on January 9, 1986, with the maximum backscattering ratio of about 2 at 21 km altitude.

The observation of atmospheric electricity at Sakushima Observatory has been continued completely in a routine base. The Observatory serves also as a station for the environmental radioactivity since April 1984, in the cooperative work with the Department of Nuclear Engineering, Nagoya University.

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Publications (1984—1986)

Ito, T., Y. Morita and Y. Iwasaka: Balloon-borne observation of aerosols in the antarctic troposphere and stratosphere, *Tellus* (1986). (in press)

- Iwata,A., and M.Takagi: Lidar observation of decaying El Chichon eruption cloud over Toyokawa, Japan (35°N), Res. Lett. Atmosf. Elect., 4, 11-16 (1984).
- Kondo,Y., A.Iwata, W.A.Matthews, Y.Morita and M.Takagi: Measurement of oxides of nitrogen in the free troposphere over Japan, Proc. Int. Ozone Sympos., Greece, Reidel Publ. Co., 180-183 (1985).
- Kondo,Y., A.Iwata, W.A.Matthews, Y.Morita and M.Takagi: Aircraft measurement of NO_x along the eastern rim of the Asian continent, submitted to J. Atmosf. Chem.
- Kondo,Y., A.Iwata, M.Takagi and W.A.Matthews: Balloon-borne chemiluminescent sonde for the measurement of tropospheric and stratospheric nitric oxide, Rev. Sci. Instrum., 55, 1328-1332 (1984).
- Kondo,Y., A.Iwata, M.Takagi and Y.Morita: Aircraft observation of NO_x in the troposphere at mid-latitude, Handbook for MAP. (in press)
- Kondo,Y., W.A.Matthews, A.Iwata and M.Takagi: Measurement of nitric oxide from 7 to 32 km and its diurnal variation in the stratosphere, J. Geophys. Res., 90, 3813-3819 (1985).
- Kondo,Y., W.A.Matthews, A.Iwata and M.Takagi: Measurement of nitric oxide from 7 to 32 km and its diurnal variation in the stratosphere, Handbook for MAP. (in press)
- Matthews,W.A., Y.Kondo, A.Iwata and M.Takagi: Nitric oxide profile from 7 to 32 km, Proc. Int. Ozone Sympos., Greece, Reidel Publ. Co., 175-179 (1985).
- Morita,Y. and M.Takagi: Balloon measurement of enhanced stratospheric aerosol layer at mid-latitude after El Chichon eruption, Res. Lett. Atmosf. Elect., 5, 23-26 (1985).
- Morita,Y., M.Takagi, Y.Iwasaka and A.Ono: Balloon measurements of aerosols in the antarctic stratosphere, Handbook for MAP. (in press)
- Morita,Y., M.Takagi and Y.Kondo: Aircraft measurements of aerosols in the upper troposphere at mid-latitude, Handbook for MAP. (in press)
- Ogawa,T., N.Iwagami and Y.Kondo: Solar cycle variation of thermospheric nitric oxide, J. Geomag. Geoelect., 36, 317-340 (1984).
- Takagi,M. and A.Iwata: Solar influence on the earth's electric field, Proc. VII Int. Conf. Atmosf. Elect., Amer. Met. Soc., 107-110 (1984).
- Takagi,M., A.Iwata and Y.Kondo: Behavior of decaying El Chichon cloud over Toyokawa, Japan (35°N) observed by 532-nm lidar, Handbook for MAP. (in press)
- Takagi,M., Y.Kondo and A.Iwata: Observation of stratospheric aerosol

and ozone by the satellite "Ohzora", submitted to J. Geomag. Geoelect.

Takagi, M., Y. Morita, A. Iwata and Y. Kondo: On the observation techniques for stratospheric aerosols, J. Met. Soc., Japan, 63, 277-282 (1985).