

Proceedings of the Research Institute of Atmospheric,
Nagoya University, vol. 37 (1990) -Activity Report-

Group 2.2 Atmospheric Composition and Structure

Atmospheric environment in global scale has been recognized as having a progressive importance for the future of our earth. The activities of this group are advanced along the lines investigating especially stratospheric problems.

A balloon campaign was carried out at Esrangle in Kiruna, Sweden in January to February, 1989 in cooperation of Sweden, France, U.S.A., New Zealand, West Germany, and Japan. The main aim of the campaign is to investigate the physical and chemical processes in the cold winter stratosphere which has attracted our intense attention since the appearance of ozone hole in the Antarctic spring. Two members from our group, Y. Kondo and N. Toriyama, attended the campaign and measured the concentrations of O_3 , NO_2 , HNO_3 , NO_y , and aerosols on board the balloons launched by CNES on January 23 and 30, 1989. They also made ground based optical measurements of NO_2 and O_3 . These observations showed that the Arctic stratosphere in January was chemically perturbed by heterogeneous reactions. Overall supports for our balloon experiments were given by CNES and CNRS of France. Expenses for travel and manufacturing instruments were partially provided by Scandinavia-Japan Sasakawa Foundation and Nissan Science Foundation. We are deeply indebted to these supports.

Balloon measurement of stratospheric aerosols has been made at Syowa Station, Antarctica to understand processes of ozone destruction. These measurements suggested that the winter enhancement of the stratospheric aerosols contributed transport of gases and particulate matters from the stratosphere to the troposphere.

Y. Kondo joined in the aircraft campaign (INSTAC-I) promoted by the Meteorological Research Institute between March 7 and 10, 1989. Our group took part in measurements of NO and O_3 . The campaign covered latitude range from $35^\circ N$ to $5^\circ S$. The cruising altitude was about 4.5 km and most of the measurements were made at this level. The observation showed that the boundary of the equatorial lowest NO region (concentration of about 5 to 15 pptv) was located at 6 to $10^\circ N$, depending on the longitude and meteorological conditions. Ozone concentration near the equator was about four times smaller than that at mid-latitudes. During take off and landing at Iwo ($25^\circ N$), Saipan ($16^\circ N$), Yap ($8^\circ N$), Biak ($1^\circ S$), Davao ($7^\circ N$), Manila ($15^\circ N$), and Naha ($26^\circ N$), the altitude profiles of these species were also obtained. The air below 3 km near some airports was more or less polluted, but the results obtained at remote locations such as Biak suggested that the equatorial air was highly isolated

from mid-latitude air.

During the period of GLOBE (Global Backscatter Experiment, 1989), Y. Iwasaka and M. Kanada observed aerosol content and sampled particulate matter using aircraft at Nagaya. Scientific teams of NASA made cooperative measurements of aerosols by DC-8 near Japan Island.

As a method to observe stratospheric NO_2 and O_3 , a ground based spectroscopic system was developed in cooperation with DSIR, New Zealand. The system is capable of observing columnar density of NO_2 and/or O_3 at sunrise or sunset hours. In August Dr. W. A. Matthews of DSIR came to Japan and discussed with us definite observation plan in the Antarctic region. Two sets of this system were sent to Syowa Station and the continuous observation is to be started in 1990. We also participate in Polar-Patrol-Balloon Project sponsored by the National Institute of Polar Research and prepare the aerosol observation in the Antarctic stratosphere.

The observation at Sakushima Observatory is continued mainly for collecting the atmospheric electrical data to investigate long range variations.

Y. Kondo attended the Gordon Conference on Atmospheric Chemistry in Boulder, Colorado in June and Airborne Arctic Stratospheric Expedition Science Meeting at Lake Tahoe, California in July. He also participated in the investigation of the site for equatorial radar in Bukittingi near Padan, Smatra, Indonesia in September.

February 28, 1990

- Masumi Takagi -

- Yasunobu Iwasaka -

Publications (1988-1990)

- Hofmann, D.J., T.L. Deshler, P. Amedieu, W.A. Matthews, P.V. Johnston, Y. Kondo, W.R. Sheldon, G.J. Byrne, and J.R. Benbrook, Stratospheric clouds and ozone depletion in the Antarctic during January 1989, *Nature* **340**, 117-121, 1989.
- Ishimaru, H., A. Iwata, Y. Kondo, and M. Takagi, Preliminary lidar observation of tropospheric ozone profile, *Proc. Res. Inst. Atmospheric, Nagoya Univ.*, **36**, 1-9, 1989.
- Iwasaka, Y., M. Yamato, R. Imasu, and A. Ono, Transport of Asian dust (KOSA) particles; importance of weak KOSA events on the geochemical cycle of soil particles, *Tellus*, **40B**, 494-503, 1988.
- Iwasaka, Y., Aircraft measurements on vertical changes in aerosol parameters - Remote sensing with detection of upwelling radiance from an atmosphere-ocean surface

- system, *J. Geomag. Geoelectr.*, **41**, 851-870, 1989.
- Iwasaka, Y., Volcanic disturbance and winter enhancement of aerosol in the Antarctic stratosphere, *J. Geomag. Geoelectr.*, **41**, 769-781, 1989.
- Iwasaka, Y. and Y. Morita, Antarctic stratospheric aerosols -Size and number concentration measured by balloon, *J. Geomag. Geoelectr.*, **41**, 613-626, 1989.
- Iwasaka, Y. and Y. Sasano, Transport of KOSA and its effect on global circulation of soil particles -lidar measurement-, *Rev. Laser Eng.*, **17**, 168-174, 1989. (in Japanese)
- Iwasaka, Y. and A. Nomura, Aerosol particles and Na vapor in the antarctic middle atmosphere -lidar measurement-, *Rev. Laser Eng.*, **17**, 175-182, 1989. (in Japanese)
- Iwasaka, Y. and M. Hayashi, Effect of polar stratospheric clouds on geochemical cycle of stratospheric material -stratospheric particle precipitation-, *Proc. NIPR Symp. Polar Meteorol. Glaciol.*, **3**, 1990, in press.
- Iwata, A., Y. Miyazaki, and M. Takagi, Backscattering signals of short pulsed light by random diffused media, *1989 Int. Symp. EMC*, 923-924, 1989.
- Kondo, Y., P. A. Amedieu, W. A. Matthews, D. W. Fahey, D. G. Murcray, D. J. Hofmann, P. V. Johnston, Y. Iwasaka, A. Iwata, and W. R. Sheldon, Balloon-borne measurements of total reactive nitrogen, nitric acid, and aerosol in the cold Arctic stratosphere, *Geophys. Res. Lett.*, 1990, in press.
- Kondo, Y., P. A. Amedieu, W. A. Matthews, W. R. Sheldon, and J. R. Benbrook, A mid-latitude balloon-borne observation of total odd nitrogen, *Geophys. Res. Lett.*, 1990, in press.
- Kondo, Y., Y. Iwasaka, T. Oguti, N. Toriyama, A. Iwata, P. A. Amedieu, W. A. Matthews, P. V. Johnston, W. R. Sheldon, J. R. Benbrook, D. J. Hofmann, and B. Hultqvist, International Arctic Ozone Campaign, *Bull. Inst. Space Astron. Sci.*, **24**, 64-74, 1989. (in Japanese)
- Kondo, Y., A. Iwata, P. A. Amedieu, W. A. Matthews, W. R. Sheldon, and J. R. Benbrook, Nitric oxide in the upper stratosphere, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- Kondo, Y., A. Iwata, P. A. Amedieu, W. A. Matthews, W. R. Sheldon, and J. R. Benbrook, Profiles of nitric oxide in the upper stratosphere, *Geophys. Res. Lett.*, **16**, 1379-1382, 1989.
- Kondo, Y., A. Iwata, M. Pirre, R. Ramaroson, C. Delannoy, W. A. Matthews, M. Koike, and K. Suzuki, Diurnal variation of nitric oxide at 26 km, *Geophys. Res. Lett.*, **16**, 867-870, 1989.
- Kondo, Y., W. A. Matthews, P. A. Amedieu, and D. E. Robbins, Diurnal variation of nitric oxide at 32 km: Measurements and interpretation, *J. Geophys. Res.*, **93**, 2451-2460, 1988.
- Kondo, Y., H. Muramatsu, W. A. Matthews, N. Toriyama, and M. Hirota, Tropospheric ozone and oxides of nitrogen over the north western Pacific in summer, *J. Atmos.*

- Chem.*, **6**, 235-250, 1988.
- Kondo, Y., M. Takagi, A. Iwata, and W. A. Matthews, Diurnal variation of nitric oxide at 26 km, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- Kondo, Y., N. Toriyama, H. Jindo, M. Kanada, A. Iwata, M. Takagi, and W. A. Matthews, Diurnal variation of nitric oxide at 26 km, *Bull. Inst. Space Astron. Sci.*, **22**, 43-60, 1988. (in Japanese)
- Kondo, Y., N. Toriyama, W. A. Matthews, and P. A. Amedieu, Calibration of the balloon-borne NO instrument, *J. Geomag. Geoelectr.* **41**, 507-523, 1989.
- Matthews, W. A., N. B. Jones, Y. Kondo, and M. Takagi, In situ NO and NO_x measurements at Lauder, New Zealand, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- Matthews, W. A., Y. Kondo, P. Fabian, and B. C. Krüger, Nitric oxide profiles measured in situ during the GLOBUS 85 campaign, *J. Atmos. Chem.*, **8**, 229-240, 1989.
- McKenzie, R. L., W. A. Matthews, Y. Kondo, P. Fabian, R. Zander, F. J. Murcray, and J. A. Pyle, NO column measurements: Intercomparison during MAP/GLOBUS 1985, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- McKenzie, R. L., W. A. Matthews, Y. Kondo, R. Zander, Ph. Demoulin, P. Fabian, D. G. Murcray, O. Lado-Bordowsky, C. Camy-Peyret, H. K. Roscoe, J. A. Pyle, and R. D. McPeters, Intercomparison of NO column measurements during MAP/GLOBUS 1985, *J. Atmos. Chem.*, **7**, 353-367, 1988.
- Naudet, J. P., M. Pirre, R. Ramaroson, P. Rigaud, P. Fabian, H. Helton, N. Iwagami, K. Shibasaki, T. Ogawa, Y. Kondo, W. A. Matthews, J. P. Pommereau, F. Gutail, P. A. Amedieu, P. C. Simon, and W. Peetermans, Diurnal variation of stratospheric NO and NO₂ from MAP/GLOBUS 1985, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- Nomura, A., Y. Iwasaka, H. Fukunishi, T. Hirasawa, S. Kawaguchi, and T. Kano, Dynamics of the mesospheric sodium layer in Antarctica: Lidar measurements at Syowa Station, 1985, *Proc. NIPR Symp. Upper Atmos.*, **1**, 75-83, 1988.
- Pommereau, J. P., F. Gutail, Y. Kondo, and W. A. Matthews, An NO_x source in the upper troposphere, *Proc. Quadren. Ozone Symp.*, 1990, in press.
- Takagi, M. and A. Iwata, Seasonal variation of stratospheric aerosols as observed by lidar at Toyokawa, *Res. Lett. Atm. Elect.*, **8**, 43-50, 1988.
- Takagi, M., A. Iwata, Y. Kondo, and Y. Morita, Initial results of the satellite "Ohzora" observation of stratospheric aerosol and ozone, *J. Geomag. Geoelectr.*, **40**, 313-320, 1988.
- Yamato, Y., Y. Iwasaka, G. W. Qian, A. Ono, T. Yamanouchi, and A. Sump, Sulfuric acid particles and their neutralization by ammonia in the marine atmosphere: measurements during cruise from Japan to Antarctica, *Proc. NIPR Symp. Polar Meteorol. Glaciol.*, **2**, 29-40, 1989.
- Yamazaki, K., K. Okada, and Y. Iwasaka, Where do aerosol particles in the Arctic upper troposphere come from? - A case study in January 1983-, *J. Meteorol. Soc. Japan*, **67**, 889-906, 1989.