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Group 2.2 Atmospheric Composition and Structure

Various photochemical reactions occur in the atmosphere by absorbing energy from the sunlight. Substances generated in these reactions determine chemical properties of the atmosphere and then control thermal structure on the earth. It is an important task to understand quantitatively the behaviors of such atmospheric minor constituents as having a close relation with the human environment. The research group on atmospheric composition and structure in this institute has continued their effort in obtaining further information on the distribution and time variation, especially of nitrogen oxides and aerosols. The following is the summary of research activities in 1988.

A balloon observation of NO and $NO_y(NO+NO_2+HNO_3+N_2O_5+HO_2NO_2+$ ....) was carried out at Gap-Tallard $(44°N, 6°E)$ in France on June 18, 1988 in the CNES campaign. Two members from this group, Y. Kondo and N. Toriyama, brought our balloon-use apparatus for NO/NO_y to take part in the campaign. All facilities and ground support for the experiment including balloon and accessories, balloon control, payload recovery, etc. were kindly provided by CNES and CNRS, to whom we are deeply indebted. A balloon of $400,000m^3$ capacity was launched at $0500UT$ and reached the maximum altitude of 39 km at 0730. It stayed at this level until 1200 and then started to descend slowly. In ascending from 6 to 39 km and in descending from 39 to 30 km, excellent data on the NO profile were obtained. The result was in relatively good agreement with those obtained in preceding years. Now these measurements are forming a useful data base for NO profile from summer to fall at northern mid-latitudes. The time variation of NO in level flight at 39 km showed first a definite morning increase of NO in the upper stratosphere, which reached a stable daytime value by around $1000UT$. This was contrasted with the variation at 26 km measured last year, where the increase of NO after sunrise continued until afternoon. This is regarded as the first evidential observation of the difference of NO generation due to N_2O_5 photo-dissociation between middle and upper stratosphere. The detailed analysis of total NO_y concentration and comparison of simultaneously measured NO_2 and NO data are in progress.

The comparative measurement program of ground surface NO, NO_2, O_3, and aerosols at Lauder $(45°S, 170°E)$, New Zealand has entered its third year. Four members, Y. Kondo, A. Iwata, M. Kanada, and N. Toriyama, visited Lauder Atmospheric Station of PEL for 3 weeks from the beginning of November, 1988 with the aid of the

international cooperative research program of JSPS. During their stay they measured the outgoing flux of $NO_x(NO+NO_2)$ from the ground, and made mutual comparison of NO_2 measurement between our photochemical method and PEL's spectroscopic method. The measurements are still continued, thanks to the staff at Lauder Station, and the data are periodically sent to us. Analyzed so far are the diurnal and seasonal variations of NO_x, flux density of NO_x from the ground, reasons for systematic difference between photochemical and spectroscopic methods, and so on.

The lidar observations during 4 years until 1986 at Toyokawa were analyzed. The stratospheric aerosols in these years were in a steady decay trend after the drastic El Chichon eruption. The seasonal variation, from a high aerosol concentration in winter to a low one in summer, was confirmed to be superposed on the decay trend. The state of stratospheric aerosols is thought to have almost reverted to the background in 1987.

The atmospheric electrical observations are being continued at Sakushima Observatory and the data are being accumulated to investigate the long-term variation due to the solar activity effect or the atmospheric conditions. The ozone measurement at Moshiri Observatory is also being continued in collaboration with the National Institute of Environmental Science.

Y. Kondo attended the Ozone Symposium held in West Germany in August 1988 and discussed the results of balloon observations in France and Japan and of ground observations at Lauder, New Zealand.

Y. Morita resigned from the Institute in April for personal reasons.

March 1, 1989

- Masumi Takagi -

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