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Section 2. Sources of Atmospherics and Atmospheric Electricity

The study of stratospheric minor substances has been continued in 1987 as a part of MAC (Middle Atmosphere Cooperation). The balloon observations of nitric oxide were made this year in Japan and also in France. A chemiluminescent NO detector was launched by using 15,000 m^3 balloon (B15-C2) from Uchinoura, Kagoshima Prefecture (31°N, 131°E) at 0030 JST on July 29, 1987. The balloon launching, telemetry and payload recovery were performed by Institute of Space and Astronautical Science in cooperation with Academia Sinica. The main purpose of the experiment was to measure precisely the diurnal variation of NO in the lower stratosphere through a long time flight from Japan to China continent. Upward and downward radiation intensities were also monitored. The balloon reached a ceiling altitude of 26 km around 0200 JST and floated at this altitude until 1600 JST when it started a slow descent. The payload was finally recovered at 80 km east of Nanking, China (32°N, 119°E) and sent back to us. The NO measurement was mostly performed over the East China Sea. At local sunrise the NO concentration increased rapidly for about 30 minutes. A slow increase of NO continued until early in the afternoon. Near noon during this course, the payload was in the shadow of balloon overhead and the measured NO concentration was apparently decreased.

The second experiment this year was made on September 17 at CNES balloon launching center, Aire sur l'Adour, France (44°N, 0°W). Kondo and Toriyama attended this campaign. To improve the precision of NO measurement in the upper stratosphere the sample flow rate was precisely determined at pressures down to 2 mb. The balloon reached a float altitude of 40 km around 0500 UT(=local standard time), 10 minutes before the sunrise. A very rapid increase of NO was observed for about 20 minutes after the sunrise, and followed by much slower increase continuing for at least 4 hours. During the slow balloon descent from 40 to 24 km between 1000 and 1300 UT an excellent NO profile was obtained. The values of NO and simultaneously measured ozone were compared with the previous observations.

An important event in the antarctic stratosphere in these 10 years

is the spring time ozone depletion called generally as "ozone hole". Many different chemical or dynamical models have been proposed to explain this phenomenon. A probable model is concerned with heterogeneous chemistry involving surface reactions on cloud particles, recognizing the coincidence of polar stratospheric clouds and ozone depletion. In cooperation with Water Research Institute, Nagoya University and National Institute of Polar Research, balloon experiments have been prepared to observe the size distribution and chemical composition of aerosols in antarctic spring. As the actual work in 1988 and 1989 the simultaneous balloon flights at Syowa Station and at McMurdo(US) or Scott(NZ) Station will be carried out by the aid of Nissan Science Foundation and others.

The lidar at Toyokawa was set up this year to observe the vertical distribution of ozone. The system is composed of the second harmonics of dye laser pumped by the 532-nm YAG laser. With careful tuning, though the available UV-laser power was still considerably smaller than the first expectation, the ozone profile became observable up to 6 km or more through the differential absorption technique.

The comparative measurement program of ground surface nitric oxide, nitrogen dioxide, ozone and aerosols, which commenced at Lauder, Central Otago, New Zealand (45^{o}S, 170^{o}E) in August, 1986, was approved as an international cooperative research 1987-1988 of Japan Society for the Promotion of Science. Three members, Takagi, Kondo, and Kanada, stayed in PEL (Physics and Engineering Laboratory), Lauder Atmospheric Station for 3 weeks from the end of October, 1987. NO_2 data from our in situ chemiluminescent instrument were compared with the remote measurements of NO_2 made at the same site using a scanning monochrometer and a distant light source. The temporal variations seen in NO, NO_2, ozone and aerosols were examined. The measurements are continued at the present by the aid of staff at Lauder station, and the data are periodically sent to us for the processing.

The atmospheric electrical data at Sakushima Observatory are continuously being accumulated for the investigation of long term variation due to the changes in solar activity or the atmospheric environment. The in situ ground surface ozone measurement is also being made at Moshiri Observatory as a cooperative work with National Institute of Environmental Science.

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