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Section 2. Sources of Atmospheric and Atmospheric Electricity

This section is mainly concerned with investigations conducted in recent years into the electrical properties and related elements in the atmosphere from the earth's surface to an approximate altitude of 100 km. The MAP (Middle Atmosphere Program), which aims at developing an adequate description of physical and chemical aspects of the stratosphere and the mesosphere, starts in 1982. We participate in the program with the measuring of such atmospheric minor constituents as ions, aerosols, ozone, and nitrogen oxides. In the year 1981 several technical problems were investigated by laboratory tests and by in situ observations.

On September 29, we measured the aerosol density using a balloon of 5000 m³ capacity (B5-106) launched from Sanriku Balloon Center, Institute of Space and Astronautical Science. This was the third trial utilizing the solar occultation method to obtain the vertical distribution of aerosol extinction coefficients at altitudes of 8 to 24 km. Compared with the results obtained in the early summers of 1978 and 1979, the results, this time, were characterized by an exceptional increase in the aerosol density at the tropopause level and a decrease in the upper troposphere. The increase around the tropopause may be an aftereffect of successive volcanic eruptions since May 1978 of Mt. St. Helens.

Another purpose of this balloon experiment is to check the performance of the aerosol monitor on board the EXOS-C satellite which is scheduled to be in operation from February, 1984. The check of the system was also made by a sounding rocket (S-310-11) launched from Kagoshima Space Center, ISAS on September 7. The construction of the aerosol monitor which utilizes the absorption of sunlight passing through the earth's limb was shown to be adequate as a satellite payload.

The laboratory's main endeavor was in preparing new devices for observations of Aitken-size aerosols and nitrogen oxides in the stratosphere, which are necessary to apply to density values much lower than

those on the earth's surface. The observation of the above two elements has not yet been tried in Japan, and it is an important task for the MAP.

A powerful tool for measuring stratospheric minor constituents from the ground is laser-radar. The budget for constructing a new laser-radar system at our institute was approved in fiscal year 1981. The system will be completed by March 1982 and contribute to the MAP together with in situ observations using aircrafts and balloons.

The tropospheric environment is also an important problem in the field of our investigation. Aircraft observations were made in 3 km altitudes similarly to the last years to understand the general behavior of particulate pollutants dispersing from land source areas widely over to the ocean. In February and April 1981, measurements taken on board a Cessna 402 were made in cooperation with a group from the Meteorological Research Institute to survey the distribution of "yellow sands" flown from the continent. Aircraft surveys were repeated in October and December to study seasonal variations in the distribution of aerosols with the size of 0.01 to 10 μm .

The observations at Sakushima Observatory are continuing on atmospheric electrical and meteorological parameters. The data accumulated in the past 10 years are being analyzed.

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