A-1 Clarification of Temporal and Spatial Variability of the ozone Layer

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Ground-based remote sensing techniques have potentials to give comprehensive information and long term data. These techniques are also useful to study on short term variations of ozone and related species. The purpose of this project is to develop those new techniques and to clarify the variations of ozone layer using these techniques.

1. The Infrared laser heterodyne technique has been applied to measure the vertical profiles of ozone, nitrous oxide and methane up to 30 km. As ozone profiles can be measured in ten minutes, ozone variations related to stratospheric folding have been easily observed. The measured ozone profiles were compared with the potential vorticity and the mechanism of those ozone variation was examined.

2. The millimeter ozone sensor operated at 110 GHz employing an SIS mixer receiver has been developed to measure the vertical profiles of ozone from 35 km to 75 km with an integration time of 3 minutes, which made it possible to observe rapid changes of ozone mixing ratio around sunrise and sunset.

3. A FTIR spectrometer with resolution of 0.02 cm-1 for airborne experiments was developed. The latitudinal distribution of the total stratospheric HCl was successfully measured by the airborne experiment carried out on December 16-22, 1992 between 25°N - 45°N over Japan. The preliminary analysis showed that total stratospheric HCl was higher in the higher latitudes.

4. A small new type optical ozone instrument was developed for a rocket-borne drop sonde to measure the vertical profiles of ozone from 20 km to 55 km with high altitude resolution and high precision.

5. The stratospheric aerosols due to the eruption of Mt. Pinatubo were observed at Tsukuba, Wakkanai and Poker Flat in Alaska. A part of the aerosol layer arrived at Tsukuba only two weeks after the eruption. The transport processes, variations and size distributions of the aerosols were examined.

6. Data obtained with an ozone lidar (laser radar) were estimated and analyzed through internal checks and comparison with the data measured by SAGE II satellite sensor. Seasonal variations of ozone profiles from 20 km to 40 km were examined. Temperature profiles from 30 km to 80 km obtained with the lidar and their variations were examined. Campaign measurements of the vertical profiles of ozone with different instruments and their comparisons were carried out.