A-1 Ozone depletion mechanisms and modeling from satellite, balloon and ground based data

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Total Budget for FY1996-FY1998 519,660,000 Yen (FY1998; 177,505,000 Yen)

Key Words Ozone depletion in the northern high- and mid-latitude, ILAS, polar vortex, Global Circulation Model (GCM), Heterogeneous reactions

In the northern and southern polar vortices, ozone was seriously depleted in these years. The chlorine and bromine chemistries, low temperature, and the dynamical behavior of polar vortices must be responsible for the ozone depletion in these regions. At mid-latitudes, there has been a statistically significant decline in stratospheric ozone. The markedly depleted ozone was occasionally observed especially in the northern mid-latitude, which seems to be partly due to a chemically depleted vortex being overhead. Hence, the dynamics and the physical and chemical processes of polar vortices were studied. This project was also aimed at understanding their impacts on ozone depletion both in the polar and mid-latitude regions. The following results are highlighted in this study.

1. The maximum ozone depletion rate of > 50 ppbv/day was obtained in the Arctic at 450 K isentropic level in late February 1997 by applying the "Match technique" for the ILAS data.
2. The integrated loss of ozone for two months (February to March, 1997) in Arctic was estimated to be about 50 % from ILAS data and ozonesonde data.
3. The markedly depleted ozone event was observed in Hokkaido in April 1996. This was explained in terms of a chemically depleted vortex being overhead. The ozone depletion in the vortex was estimated to be more than 50 % by comparing with the data observed under the similar meteorological condition in 1972.
4. A special campaign of ozonesonde observation at Tsukuba demonstrated that the ozone concentration over Tsukuba was influenced by the advection of air with less ozone from other regions such as the polar region and the low-latitudes.
5. Characteristics of the seasonal and annual variation of ozone-related species were analyzed by means of statistical method using meteorological data and satellite data.
6. A chemistry-coupled GCM and a nudging CTM were developed. The results of the GCM were compared to the TOMS and UARS observations and ILAS data.
7. A new sensitive detector of molecular chlorine was developed. The interference from other atmospheric trace gases seems to be negligible.

This project was carried out in close collaboration with the ADEOS ILAS/RIS project and European projects such as OSDOC and THESEO. It also partly supported some NDSC complementary measurements in Japan and was a contributing project to WCRP/SPARC.