

### **A-3 Studies on Physical and Chemical Processes in the Stratospheric Ozone Layer and Numerical Modeling**

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Laboratory studies, field measurements, process studies and numerical modeling have been carried out in this project to understand the physical and chemical processes related to the ozone layer and to give better background for prediction of future of it.

1. In order to clarify the generation and extinction processes of the Polar Stratospheric Clouds (PSCs), an experimental apparatus, a method to generate the particles, which are the models of the PSCs, and an in-situ measurement system of the particles have been developed.
2. Importance of physical processes related to PSCs, such as condensation growth, descending motion and scattering of solar radiation, were studied using numerical model. The descending loss of type I PSCs is an important process as denitrification of the polar stratosphere in winter. The scattering effects of solar radiation by PSCs may activate ozone loss in winter.
3. A photochemical reaction chamber is used to carry out simulation experiments of the ozone loss by the addition of halocarbons. The loss rates of ozone by CFCs, halons and HCFCs were determined. Synergistic effect of halon on ozone depletion by CFC was first demonstrated experimentally. The rates of radical reactions related to ozone loss have been measured using a laser photolysis-photoionization mass spectrometry.
4. Mechanism of variations of ozone was analysed using meteorological data and the NIES one dimensional model. The seasonal variation of ozone profiles 30 km - 40 km was simulated well using one dimensional data. To model the heterogeneous processes, surface area of aerosols is important. Then, we estimated the aerosol size distribution using a lidar and an aureolemeter. Numerical studies on the breakdown of the polar vortex have been carried out.