Proc. NIPR Symp. Polar Meteorol. Glaciol., **9**, 184, 1995

STRATOSPHERIC HCL, HF, AND N_2O IN ANTARCTICA OBSERVED WITH SOLAR INFRARED ABSORPTION METHOD (ABSTRACT)

Isao MURATA, Kazuyuki KITA, Naomoto IWAGAMI and Toshihiro OGAWA

Department of Earth and Planetary Physics, Graduate School of Science, University of Tokyo, 3-1, Hongo 7-chome, Bunkyo-ku, Tokyo 113

Vertical column densities of HCl, HF, and N_2O were observed using solar infrared absorption technique at Syowa Station (69.006°S, 39.590°E), to study the chemistry and dynamics of Antarctic ozone depletion. The solar spectra were taken by using a 1.5 m double-pass grating monochromator with wavenumber resolution of 0.075 cm^{-1} – 0.137 cm^{-1}, and the measurements were carried out from July to December 1991. HCl vertical column densities were observed to be $(1.65 \pm 0.43) \times 10^{15}$ cm^{-2} in winter and to increase to $(6.07 \pm 1.20) \times 10^{15}$ cm^{-2} in summer. HF and N_2O vertical column densities remained fairly constant at $(1.31 \pm 0.25) \times 10^{15}$ cm^{-2} and $(5.98 \pm 0.31) \times 10^{18}$ cm^{-2}, respectively from July to December, suggesting stable dynamical conditions. The temporal variation of the HF/HCl vertical column density ratios shows that only HCl was removed by chemical reactions during polar night. These reactions might occur on the surfaces of the polar stratospheric cloud (PSC) particles in the altitude region between 12 km and 25 km. The decrease in HCl vertical column density ($(4.4 \pm 1.6) \times 10^{15}$ cm^{-2}) during polar night implies that almost all HCl molecules in this altitude region were converted into other chlorine species and/or trapped in the PSC particles. Total ozone measured with a Dobson spectrophotometer shows that Syowa Station was located in the 'ozone hole' in mid-November, whereas the HCl vertical column density had recovered to the summer level at that time. Atmospheric temperature and wind measured with radiosondes over Syowa Station show that the air mass in the 'ozone hole' remained dynamically stable in August and September. The increase in HCl vertical column density from September to November is thought to be mainly due to chemical reactions. Comparing the observational result with a one-dimensional time-dependent photochemical model calculation, it is found that half of the decreased amount of HCl vertical column density was converted into active chlorine and that the remainder was converted into other less active chlorine species and/or trapped in the PSC particles. To describe the temporal variation of partitioning among chlorine species in detail, we must observe HCl, $ClONO_2$, and ClO simultaneously for a longer observation period, at least one year. We should also observe other chlorine species and nitrogen species.

(Received October 31, 1994)