

LASER HETERODYNE SPECTROMETER OBSERVATIONS OF  
STRATOSPHERIC O<sub>3</sub>, N<sub>2</sub>O, HNO<sub>3</sub> AND CH<sub>4</sub> AT SYOWA STATION,  
ANTARCTICA (ABSTRACT)

Michihiro KOIDE<sup>1</sup>, Makoto TAGUCHI<sup>1</sup>, Hiroshi FUKUNISHI<sup>1</sup> and Shoichi OKANO<sup>2</sup>

<sup>1</sup>*Department of Astrophysics and Geophysics, Tohoku University, Aoba-ku, Sendai 980-77*

<sup>2</sup>*National Institute of Polar Research, 9-10, Kaga 1-chome, Itabashi-ku, Tokyo 173*

Using a newly developed laser heterodyne spectrometer, we observed infrared absorption spectra of atmospheric ozone, methane, nitrous oxide, and nitric acid at Syowa Station (69.0°S, 39.6°E) in the austral spring and summer season of 1994. This spectrometer has an extremely high spectral resolution of 0.0013 cm<sup>-1</sup> and a signal-to-noise ratio of 500 for 10-min scan time. Four tunable diode lasers operating at liquid nitrogen temperature are set in the spectrometer. By choosing a particular laser as a local oscillator, we can select the wavenumber region suitable for each spectral line. The selected wavenumber regions are around 1104 cm<sup>-1</sup>, 1181 cm<sup>-1</sup>, 904 cm<sup>-1</sup> and 1223 cm<sup>-1</sup> for O<sub>3</sub>, N<sub>2</sub>O, HNO<sub>3</sub> and CH<sub>4</sub>, respectively. The observations were carried out as part of the 35th Japanese Antarctic Research Expedition program. Since the spectrometer uses the sun as the light source, observations began at the end of August 1994, and continued until January 1995. To investigate the growing phase of the Antarctic ozone hole in detail, we carried out intensive observations of ozone absorption spectra in early spring. From November 1994, we carried out mainly observations of methane absorption spectra. Absorption spectra of nitrous oxide and nitric acid were taken intermittently from September 1994 to January 1995. From the ozone absorption spectra obtained in early spring, the height profiles of ozone were retrieved at intervals of every ten minutes. These profiles showed extremely low ozone concentration in the altitude range of 15–20 km, which is a typical feature of the ozone hole. Furthermore, these profiles suggested the existence of rapid variations of ozone concentration in the altitude range of 20–30 km.

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