MEASUREMENT OF NO_2 DENSITY IN THE POLAR STRATOSPHERE: BALLOON EXPERIMENT BY THE 23RD JAPANESE ANTARCTIC RESEARCH EXPEDITION (EXTENDED ABSTRACT)

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The stratospheric NO_x (nitrogen oxides) have been measured extensively since their critical effect on the ozone layer was pointed out. However, their distributions in the polar upper atmosphere are not well known. The 23rd Japanese Antarctic Research Expedition is to fly two spectrometers on board 5000 m^3 plastic balloons at Syowa Station to measure the NO_2 density distribution in the polar stratosphere. Concerning the NO_2 density, a larger vertical content in summer than in winter has been found at high latitudes (NOXON, 1979), but few altitude profiles have been reported. The following factors may affect the NO_2 density distribution in the polar stratosphere: (i) different sunlit conditions from those at lower latitudes, (ii) different atmospheric circulations from those at lower latitudes, (iii) lack of N_2O sources; NO_x is produced from N_2O in the stratosphere, and (iv) existence of the NO_x sources due to the cosmic rays and the auroral particles.

The present measurement is based upon the absorption spectroscopy with the sun as a light source (OGAWA *et al.*, 1981; SHIBASAKI and OGAWA, 1981). The measuring instrument is composed of a sun tracker, a monochromator and a photoelectric detector, and measures the solar spectrum in the wavelength region of 430–450 nm. The present method differs from the Dobson method for the total

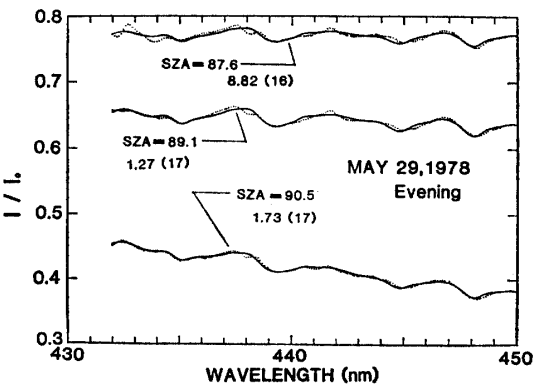

Fig. 1. Absorption spectra of NO_2 observed on a balloon flown from Sanriku on May 29, 1978 (dotted curves) and those calculated from the absorption cross sections (solid curves). The solar zenith angles and the deduced NO_2 column densities are also shown for each set of the spectra in units of degrees and cm^{-2}, respectively. The Fraunhofer lines have already been eliminated by calculating the ratio of the observed solar spectrum (I) to the reference solar spectrum (I_0) which is free from NO_2 absorption.

ozone content in that it makes use of all the data contained in that wavelength region. That is, the NO_2 column density between the sun and the detector is estimated by comparing the observed absorption spectrum with the theoretical one as shown in Fig. 1. An averaged altitude profile of the stratospheric NO_2 density can be obtained from a set of column densities measured at around sunset or sunrise.

References

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