MEASUREMENTS OF NO_2 IN THE POLAR STRATOSPHERE: PRELIMINARY RESULTS BY BALLOON EXPERIMENTS AT SYOWA STATION IN 1983 (EXTENDED ABSTRACT)

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Nitrogen dioxide (NO_2) is an important minor constituent in the stratospheric chemistry relating ozone. Thus far a lot of balloon-borne observations of NO_2 have been carried out by many scientists using a variety of techniques (see WMO, 1982; NAUDET *et al.*, 1984 and references therein). However, only a few measurements of high latitude stratospheric NO_2 have been reported (KERR and MCELROY, 1976; EVANS *et al.*, 1981), and no balloon-borne measurement has been carried out in the southern hemisphere except ours. To elucidate the latitudinal behavior of NO_2 and to check the validity of model calculations, measurements of the stratospheric NO_2 at high latitudes and, especially, in the southern hemisphere are indispensable. The first balloon-borne measurement of the stratospheric NO_2 in the Antarctic region (southern hemisphere) was made at Syowa Station (69.0°S, 39.6°E) on November 24, 1982 by the 23rd Japanese Antarctic Research Expedition (JARE-23) wintering party (IWAGAMI *et al.*, 1985). In this abstract we will present preliminary results by the JARE-24 balloon experiments.

Two 5000 m^3 plastic balloons, hereafter called B_5-JA25 and B_5-JA26, were launched from Syowa Station on November 12 and 20, 1983, respectively. After about one and a half hour ascent, B_5-JA25 reached a ceiling level of about 29 km and B_5-JA26 about 28 km. Sunset and sunrise spectra were obtained with a compact spectrometer on board the balloon. This spectrometer was essentially the same as the one used in the B_5-JA21 balloon experiment made by the JARE-23 wintering party. Figure 1 shows the deduced slant column density of NO_2 *vs.* time obtained from the B_5-JA25 balloon experiment. The data analysis procedure to deduce the NO_2 slant column density from a solar absorption spectrum was described in detail in a paper by OGAWA *et al.* (1981). For a period of November 8 to February 4 the sunset was not observed above 20 km at 69°S latitude. This period becomes longer with higher latitudes. Because B_5-JA25 drifted poleward from Syowa Station, a maximum solar zenith angle at around local midnight was about 92° in this observation, and the minimum tangential altitude was about 25 km.

Figure 2 gives a sunset profile of the stratospheric NO_2 derived from the data shown in Fig. 1. Retrieval method was also described by OGAWA *et al.* (1981). Since there remain some ambiguities in a flight course of the balloon, the profile shown in

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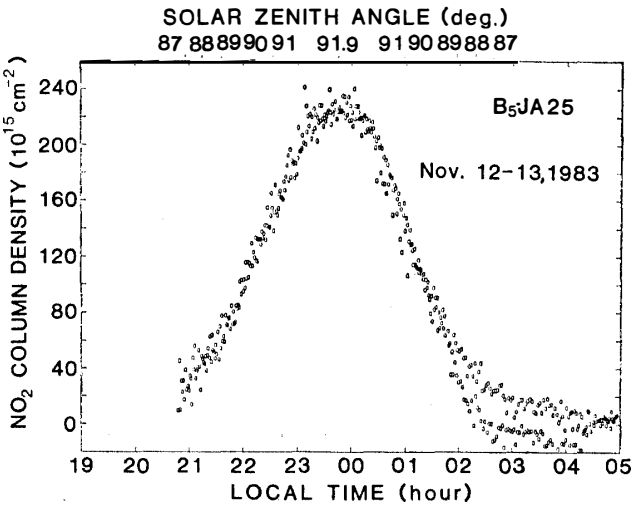

Fig. 1. Variation of slant column density of NO_2 measured by B_5-JA25 balloon as a function of local time and solar zenith angle.

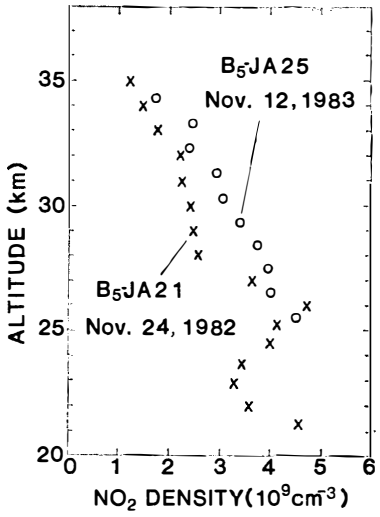

Fig. 2. Vertical profiles of the stratospheric NO_2 obtained from B_5-JA21 and B_5-JA25 balloon experiments. Crosses show the sunset profile derived from B_5-JA21 (after IWAGAMI et al., 1985), and open circles from B_5-JA25. The ceiling level of B_5-JA21 was about 25 km, while that of B_5-JA25 was about 29 km.

Fig. 2 is still preliminary. A double peak like structure was derived from the B_5-JA21 experiment (see Fig. 2), and this may be due to a difference in a wind pattern between the upper and the lower stratosphere; the horizontal transport plays an important role in determining the stratospheric NO_2 profile at high latitudes. However, the ceiling level of B_5-JA25 was higher than that of B_5-JA21 by about 4 km. It is then possible to make a comparison between the data only above 25 km, although a region below 25 km is important for considering the latitudinal variation of NO_2 and the behavior of the high latitude stratospheric NO_2. Above 25 km two profiles, one obtained by B_5-JA21 and the other by B_5-JA25 shown in Fig. 2, seem to show a slight difference in number density. Further analysis is still in progress. Detailed discussions will be given in the near future.

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