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## TOTAL OZONE BY LUNAR DOBSON OBSERVATION AT SYOWA, ANTARCTICA

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Introduction The lunar Dobson observation is almost the only one way to get the total ozone in or around the polar night season at high latitudes where the total ozone observation by solar Dobson is not available. The total ozone observations by lunar Dobson were carried out at Syowa Station (69°S, 40°E), Antarctica in 1969, and 1982 - 1986, in the months from March to October. In this paper, we describe the method, the accuracy and the results of the lunar Dobson observation carried out at Syowa Station from 1982 to 1986.

1. Instrument. The Dobson instrument used for lunar Dobson observation at Syowa Station was Beck 122, but has been Beck 119 after February 1986. These Dobson instruments are the same with that used in the ordinary solar Dobson observation. The intensity of the moonlight is not so strong that a sun director for lunar Dobson is equipped with a quartz lens ( $f=45\text{cm}$ ) to condense the moonlight. The position of the lens is set to get the maximum output in the "A" pair wavelengths. No microscope is used, however we are able to see the focused image of the moon on the input slit of the Dobson instrument.

2. Method. The total ozone measurement by lunar Dobson observation is carried out with the moon light in clear sky at night. It is possible even if thin cloud covers the moon. We need the clear image of the moon on the input slit. The observation should be carried out near the culmination of the moon. "A" and "D" wavelengths are used. The value of the extraterrestrial constant for lunar Dobson observation is the same value as that for the sun. To observe total ozone by lunar Dobson observation, five measurements with "A" and "D" pair wavelengths are carried out. The calculation of the total ozone from the data of the Dobson is made according to the WMO manual. The horizontal parallax is taken into consideration.

3. Night representative. Since the accuracy of the lunar Dobson when the height angle of the moon is not established, We call the total ozone amounts when the height angle of the moon is highest "Night representative" value. This value should be the representative in the night 12 hour before and after the culmination of the moon.

4. Accuracy. The results of the comparison of the night representative of lunar Dobson observation with the daily representative of solar Dobson is shown in Figure 1. This shows that the total ozone at night by lunar Dobson observation is about 18 matm-cm greater than that in the daytime by solar Dobson. It is necessary to check that this bias is common or not among other instruments and other station.

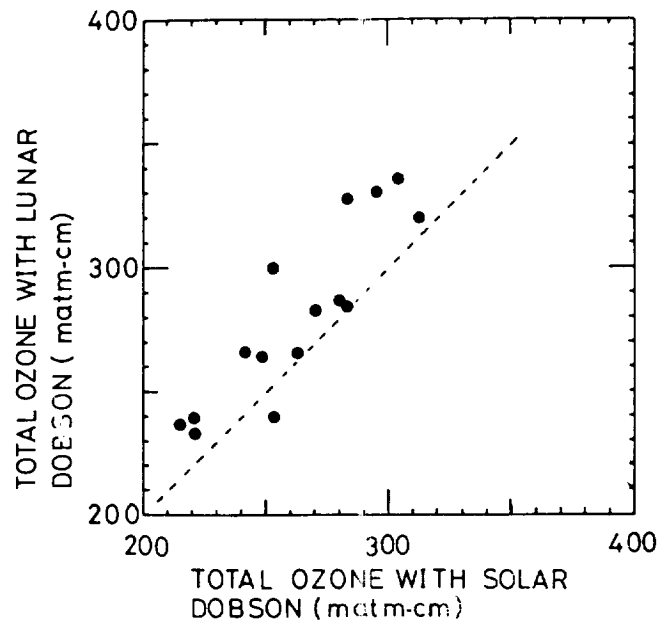


Fig.1 Comparison of the total ozone of night representative with that of the daily representative. If both daily representatives are available, The abscissa shows the mean value of the daily representative before and after the night when the lunar Dobson is carried out, else it shows the either of them. It is shown the 18 matm-cm bias in night representative by lunar Dobson.

5. Total ozone in polar night at Syowa Station. By the use of the lunar Dobson observation, we are able to get the seasonal change of the total ozone at Syowa Station including Polar night season. Figure 2 shows the 4 year mean of the daily representative total ozone at Syowa Station between February 1982 to January 1986, superimposed with the 20 year mean of the daily representative between 1961 to January 1982. It is shown that the spring time decrease starts in early or middle August. It becomes minimum in early or middle October. Then it turns to increase. it becomes maximum in early December and then decreases.

6. vertical profile of ozone decrease. Figure 3 shows the difference of the monthly means of the vertical profiles between above two periods., i.e. 1966 to January, 1982 and February 1982 to January 1986. This figure shows that the maximum decrease occurs between 150mb and 70mb in October and in November. It should be noticed that an increasing area exist at the height upper than 50 mb .

#### References

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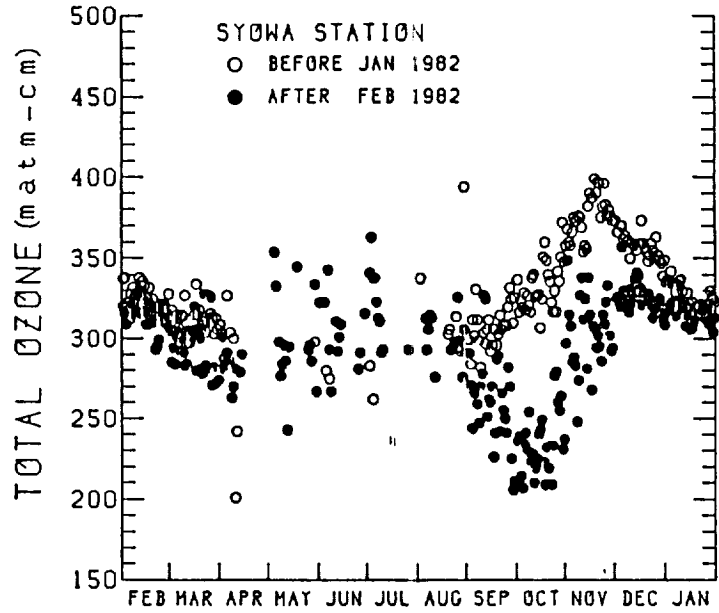


Fig.2 Closed circles shows the 4 years mean of the daily representative total ozone at Syowa Station from February 1982 to January 1986. Open circles shows the 20 years mean of the ones from 1961 to January 1982.

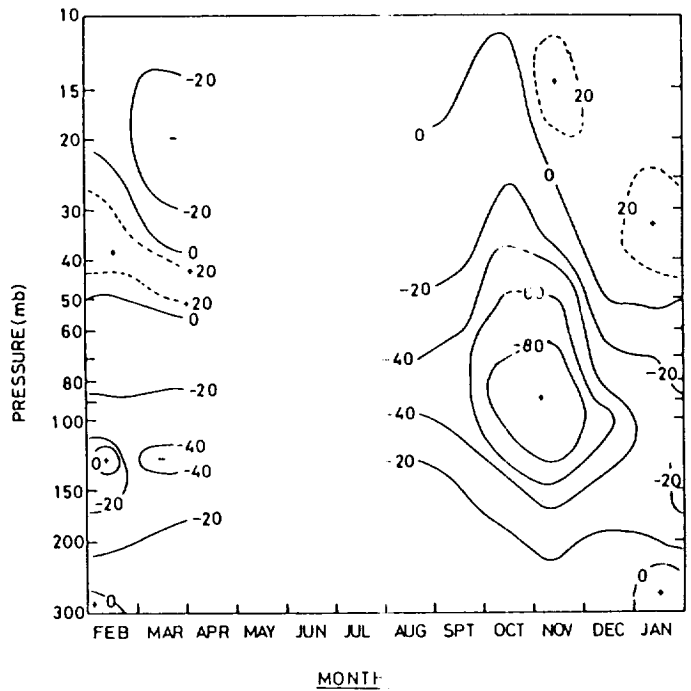


Fig.3 The difference of the monthly means of the vertical profiles of ozone partial pressure between the 1966 to January 1982 and February 1982 to January 1986.