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ON VERTICAL PROFILE OF OZONE AT SYOWA

Shigeru Chubachi

Meteorological Research Institute
1-1 Nagamine, Tsukuba, Ibaraki, 305, Japan

ABSTRACT

The difference in the vertical ozone profile at Syowa between 1966-1981 and 1982-1988 is shown. The month-height cross section of the slope of the linear regressions between ozone partial pressure and 100-mb temperature is also shown. The vertically integrated values of the slopes are in close agreement with the slopes calculated by linear regression of Dobson total ozone on 100-mb temperature in the period of 1982-1988.

1. INTRODUCTION

The spring time Antarctic ozone decrease shows that human activity is affecting the ozone layer. The range of altitude where the ozone decrease is occurring is the most important information needed to understand the mechanism of the Antarctic ozone change. In this paper the changes in vertical ozone profiles and temperature between 1966-1981 and 1982-1988 observed at Syowa Station (69°S, 40°E), Antarctica are shown.

2. DATA USED

All data at Syowa used in this paper are in the "Antarctic Meteorological Data" published by Japan Meteorological Agency as an annual report of meteorological observations at Syowa and other Japanese observational bases on Antarctica. Ozone data at the South pole are obtained from the "Ozone data for the world"s published by Atmospheric Environment Service in Canada.

3. LONG TERM VARIATION OF VERTICAL PROFILE OF OZONE AT SYOWA

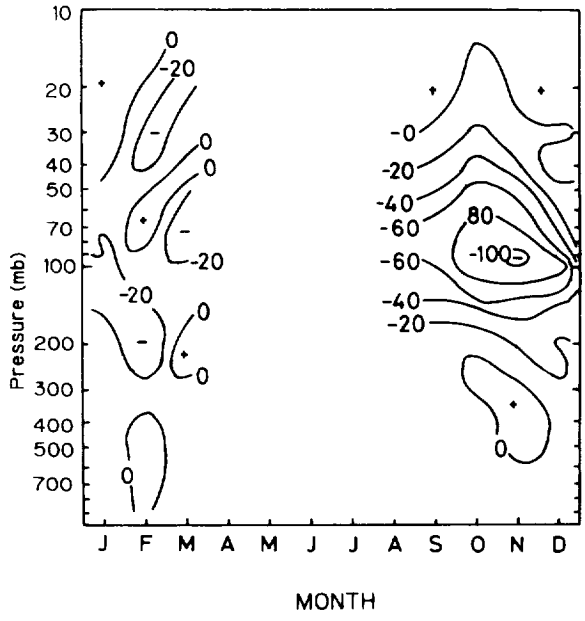

Figure 1a. The difference in the monthly mean ozone partial pressure between the periods of 1966-1981 and 1982-1988 at Syowa.

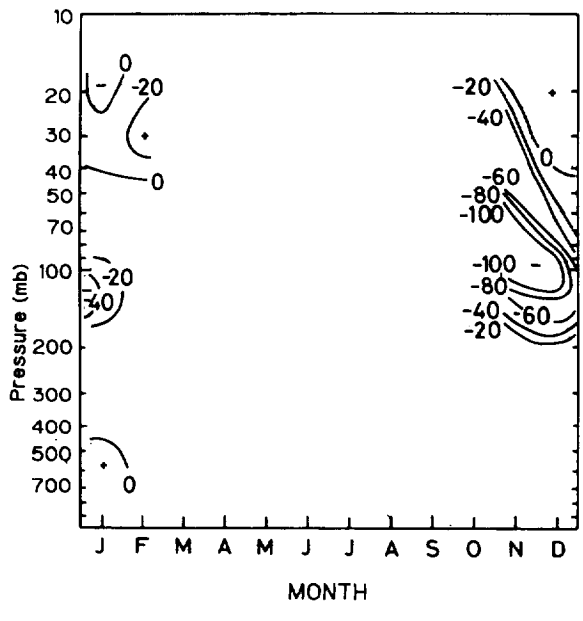

Figure 1b. As for Fig. 1, but for the South Pole.

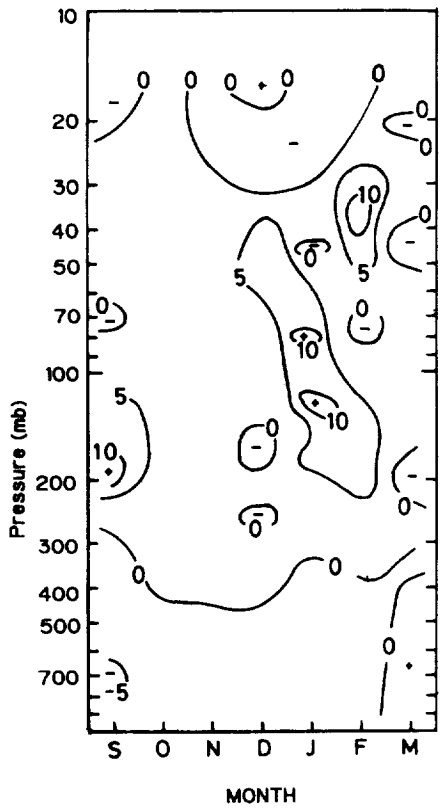

Figure 2a. The slope of the linear regressions between the ozone partial pressure and 100-mb temperature change at Syowa during 1966-1981.

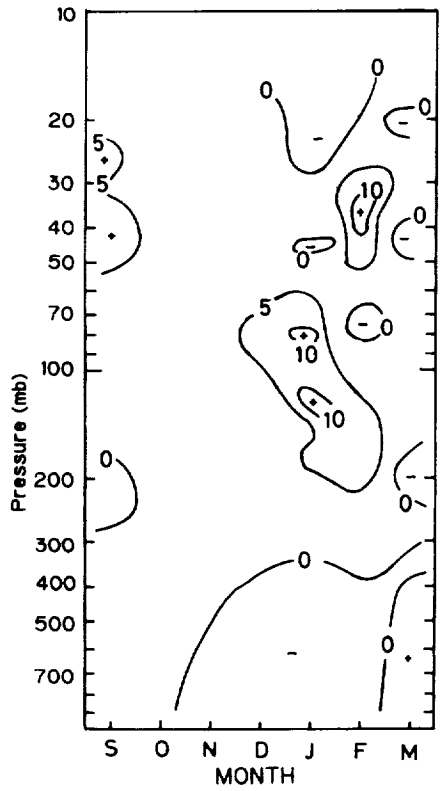

Figure 2b. As for Fig. 2, but for 1982-1988 period.

It was pointed out that a large change has been occurring in total ozone and meteorological parameters at Syowa (Chubachi, 1986). Moreover a strong positive correlation exists between total ozone amounts and the 100-mb temperature at Syowa (Chubachi, 1992). The differences in the monthly mean ozone vertical profiles between 1966-1981 and 1982-1988 at Syowa (Fig. 1a) and those at the South Pole (Fig 1b) are shown. It is easy to see from this figure that severe ozone decrease is occurring around October and November around 100-mb. Note that in the layer above 30-mb ozone increases from December to February. A region of similar increase in ozone is also seen at the South Pole. The statistical analysis shows that this increase is significant.

4. OZONE CHANGES WITH 100-mb TEMPERATURE

Figure 2a shows the slope of the regression lines between ozone partial pressure and 100 mb temperature for 1966-1981. In Figure 2b, the one for 1982-1988 is shown. In these figures, the data for the months from January through March are for the whole period 1966-1988 because there are not enough data for separate calculations. Note that the anti-correlation areas that are shown above 25 mb in the months of November and December in Fig. 2a are not present in Fig. 2b. In Figures 3a and 3b, vertically integrated change of ozone partial pressure with 100-mb for each period temperature is shown together with the change calculated from Dobson ozone observation and the routine based radiosonde observations. Note that the calculated ozone changes with 100-mb temperature changes agree well with the changes in total ozone measured by the Dobson spectrophotometer in the period 1982-1988.

5. CONCLUDING REMARKS

The vertical profile of ozone at Syowa shows that ozone increases in the region above 30-mb for the months from December through January. Similar ozone increases are also seen at the South Pole. The increase in ozone at this altitude conceals the more severe ozone decrease below this altitude.

The vertical profile of the correlation between the ozone change and 100-mb temperature change is presented. Note that the anti-correlation above 30-mb of December through January for 1961-1981 is not present in the figure for 1982-1988. The integrated ozone change agrees with the change in the total ozone measured with the Dobson instrument in the period of 1982-1988.

6. ACKNOWLEDGMENT

The author thanks K. Miyakawa of Aerological Observatory for the data.

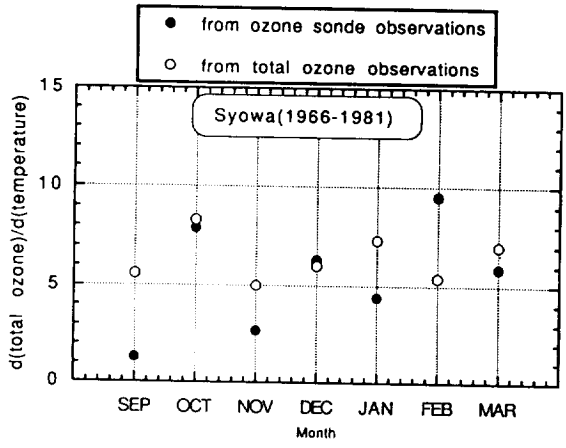

Figure 3a. Vertically integrated values of the slope of the ozone partial pressure versus 100-mb temperature for the period 1966-1981 at Syowa is shown together with the slope of Dobson total ozone versus 100-mb temperature in the same period

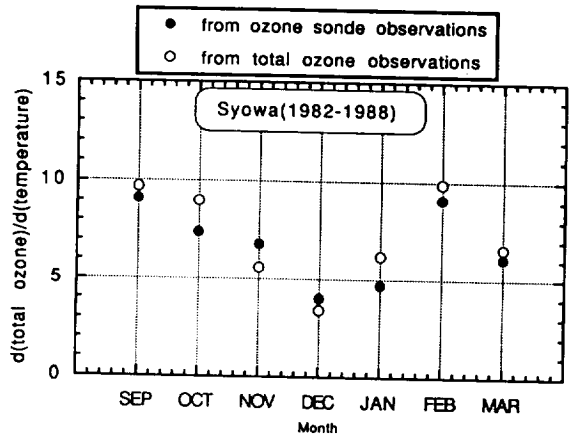

Figure 3b. As for Fig. 3a, but for the 1982-1988.

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