

Weather Conditions in the Southern Hemisphere with Special Reference to Syowa Base from January to the Beginning of February 1959*

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1959年1~2月の昭和基地を中心とする南半球の気象*

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1. 1959年1月は印度洋の東経70度線における亜熱帯高気圧が1958年に比べて強く、また南に張り出して南極大陸周辺の低圧帯はかなり南にずれている。

2. 1959年1月は25日ころまでは大西洋南部から印度洋南部まで南半球では南北循環の傾向が強く、低気圧は南東進して昭和基地に接近するものが多く、宗谷付近では天候は悪かった。このた

め宗谷は1958年および1957年の1月に比べて低い気圧を観測している。

3. 1959年1月下旬末から東西循環に変わり、南極大陸の高気圧が強くなった模様で、大陸周辺の低圧帯は北上して50°~65°Sの間に位置するようになり、低気圧は東~東南東に進むようになって、昭和基地付近の天気は全面的に良くなった。

1. Introduction

During the period that the Soya operated to help the second Japanese Antarctic Research Expedition Team fulfil the duty of IGY, the Forecasting Department of the Japan Meteorological Agency made the weather map for Antarctica and made a weather prediction around Syowa Base from 22 Jan. until 24 Feb. 1958. The prediction was presented to the Joint Promotive Headquarters of JARE and other various organizations concerned.

Similar services were extended to the third Japanese Antarctic Research Expedition Team of 1959 from 6 Jan. to 9 Feb. 1959.

During the period that the Soya operated for the third expedition team, the author was responsible for the analysis of weather maps. As the data were not enough and the period was short, detailed analysis could not be expected, however, several interesting feature were found.

2. The extent of the weather map of Antarctica

The extent of the weather map of Antarctica is shown in Fig. 1. For this extent of the weather map, the data were collected from about 15 bases of various countries, island-stations and whaling ships numbering between 10 and 20, and land-stations in

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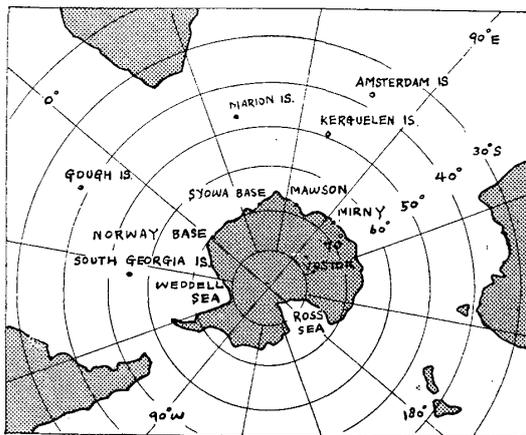


Fig. 1. Map showing the locations of stations in Antarctica.

the southern parts of South Africa, South America, Australia, and New Zealand. In analyzing weather maps, reference was made to the radio sounding observation data obtained once in a while, the surface analysis broadcast by Pretoria and Canberra were also referred. Throughout the period, the analysis covered from the southern part of South America to the southern Atlantic Ocean, Indian Ocean and New Zealand. While the southern part of the South Pacific Ocean was excluded.

3. Pressure profile along 70°E meridian

The surface pressure profiles along 70°E meridian in the Indian Ocean are made for the periods of 22 Jan. —9 Feb. 1958 and 6–25, Jan. 1959. The reasons why the

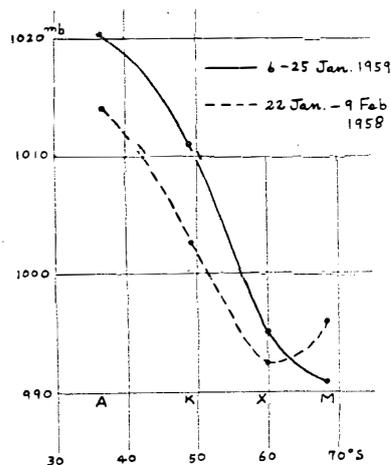


Fig. 2. Summer profile of mean surface pressure along 70°E meridian (Indian Ocean).

- A: Amsterdam Is.,
- K: Kerguelen Is.,
- M: Mawson Base,
- X: 60°S, 60°E.

date is not same are: 1) in 1958 we began to make weather maps from 22 Jan. so weather maps before this date are not available, 2) the E-W zonal index seems to have changed towards the end of January 1959. As for the data, those from Amsterdam Island (37°50'S, 77°34'E), Kerguelen Island (49°20'S, 70°13'E), Mawson Base in Antarctica (67°36'S, 62°53'E) are used. In the southern hemisphere, the zone around 60°S is characterized by the permanent low pressure, so the value of pressure at 60°S, 60°E is read from the weather map and used. As the period is short and the period of these two years do not coincide, the minute points are not known but the following features are recognized from Fig. 2.

In January 1959, the middle latitude high pressure in the Indian Ocean was strong and extended far to the south, and the low pressure zone near Antarctica deviated southward with considerable low pressure

value.

Normally the zone between 60°S and 70°S is characterized by low pressure, and it is in this zone that the lowest pressure value is observed, while according to the data of January and February of 1958, the lowest pressure value was observed in 60°S. Judging from this pressure distribution, in January 1959, they must have very hot summer in the middle latitude. The zone of bad weather around Antarctica deviated toward south and the high pressure over Antarctica was weak at least during the period.

4. General circulation until the beginning of the last decade of January, 1959

As for the east-west pressure tendency, the pressure trough was apt to be formed between 10°E and 50°E , while subtropical high pressure over the Indian Ocean often deviated toward the south and extended to the continent. The weather map of January 22, 1959 shown in Fig. 3 is a typical example of this situation. The high pressure along 90°E was well developed and extended far to Antarctica forming the so-called blocking situation. Due to this pressure distribution, the cyclones formed in the Southern Atlantic had a tendency to move SSE or SE-ward and often approached to Syowa Base.

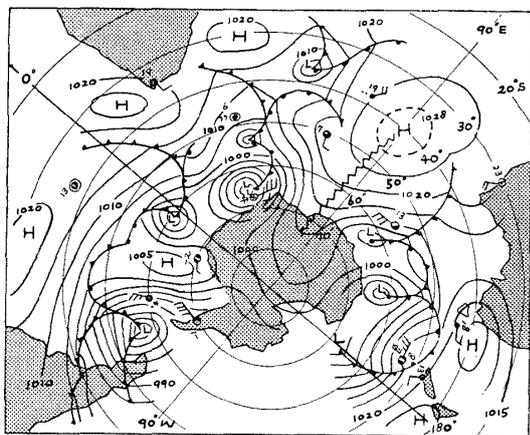


Fig. 3. Surface map for 0600Z 22 January 1959.

Fig. 4 is the pressure variation observed on board the Soya during the operation period of the Expedition Team from the first to the third research respectively. During this period, the Soya was around Lützw-Holm Bay, so the pressure value is not the one observed at a fixed point, yet it clearly shows the general tendency.

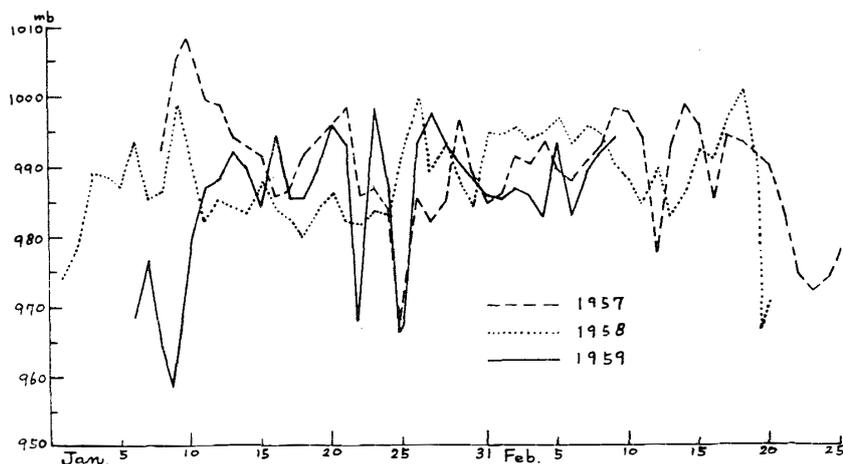


Fig. 4. Pressure changes on board the Soya during January and February. Data for 0600Z each day.

From the curves it is clearly seen that during the mid-summer period between the early January and February 10, the year of 1959 was characterized by the low pressure as is shown in the Table 1 below.

The Table 1 indicates the same tendency of the pressure profile along 70°E meridian in the Indian Ocean, at the same time this is the fact that the Glacial Anticyclone over

Table 1. Comparison of the mean pressure on board the Soya.

Year	Period	Mean pressure
1957	Jan. 8—Feb. 10 (34 days)	991.0 mb
1958	Jan. 6—Feb. 10 (36 days)	988.9
1959	Jan. 6—Feb. 9 (35 days)	985.5

Table 2. Minimum pressure on board the Soya, January 1959.

Day	Time	Minimum pressure
8	18 Z	958.0 mb
22	00	967.7
25	03	966.0

Antarctica was weak near Syowa Base in 1959.

In parallel with this low value of the mean pressure, the extreme value in the minimum pressure was also observed in 1959.

In 1959, well developed cyclones visited Syowa Base on January 5-9, 21-22 and 24-25, this is clearly seen in the curve of Fig. 4, and the values of pressure observed three hourly on board the Soya is shown in Table 2.

In the data of three years of the Soya, the dates that pressure fell down below the value of 970 mb are as follows: 00Z, 25 Jan. 1957, the value of which is 967.7 mb; none in 1958; in January 1959, three days as shown in Table 2 above.

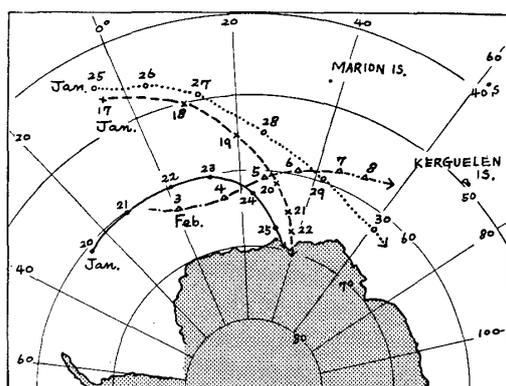


Fig. 5. Typical tracks of cyclones during January and February 1959. Daily position for 0600Z.

In the roof of the power house. It was also reported that this kind of heavy rainfall was a rare phenomenon. Typical tracks of cyclones during January and February 1959 are shown in Fig. 5 in which the tendency of southward movement in the early part of the period is seen.

5. General circulation after the end of the last decade of January, 1959

Air transportation from the Soya started again on January 26 and the weather recovered completely on January 29. The time when air transport was started is supposed to be the time when the general circulation in the southern hemisphere changed from meridional to zonal. According to the pressure curve obtained on board the Soya as is seen in Fig. 4, higher pressure is recognized after 27 January. In Figs. 6 and 7,

This fact shows that the general circulation in the southern hemisphere in January 1959 was characterized by the considerable meridional flow at least between the southern part of the Atlantic and Indian Ocean, which, together with the large pressure ridge along 90°E shown in the weather map of 22 January in Fig. 3, show the feature of the period.

According to a newspaper, the Soya Base was visited by a violent storm on the late evening of 21 January 1959, and tents were all blown down and there was a leak

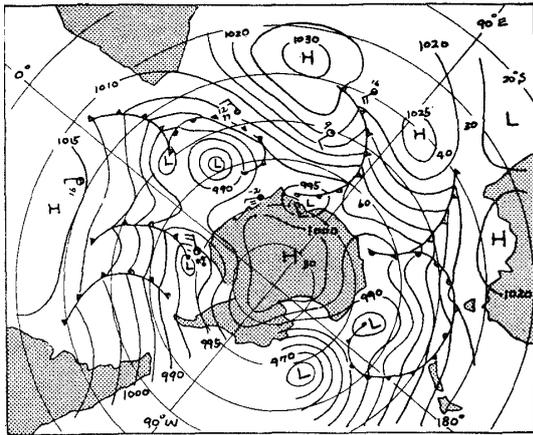


Fig. 6. Surface map for 0600Z 27 January 1959.

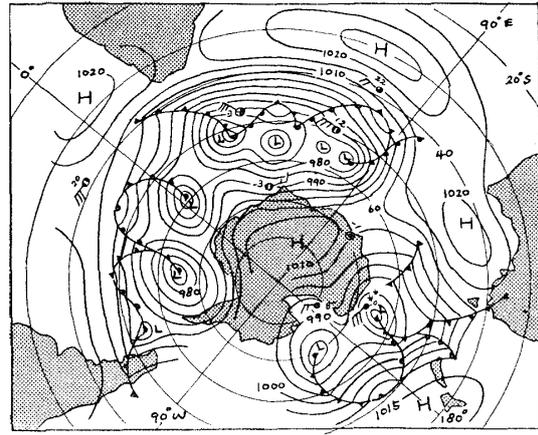


Fig. 7. Surface map for 0600Z 8 February 1959.

the weather maps for 27 January and 8 February 1959 are shown.

The track of cyclones deviated ESE or E-ward and is situated around 50°-65°S, about 10°-15° deviated to north compared with that of before the end of January. The middle latitude high pressure was also weak. This is the reason why the weather around Syowa Base was fine. The high pressure which had extended to the southern part of the Indian Ocean in the early January appeared to have been weakened considerably. The five days mean pressure curves of Amsterdam, Kerguelen, and

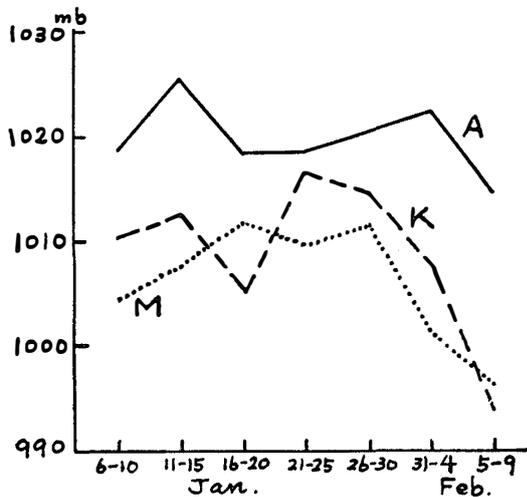


Fig. 8. Variation of 5 day mean pressure on the Indian Ocean during January and February 1959.

A: Amsterdam Is.,
K: Kerguelen Is., M: Marion Is.

Marion Islands shown in Fig. 8 indicates that at Kerguelen and Marison pressure began to fall from the end of January 1959 and a cyclone developed in the end of the first decade of February in this region.

It seems that the neighbouring waters of the Marion Island is the favorite place for the development of cyclone. This fact is also pointed out by LANGFORD¹⁾ in his investigation of the summer of 1954~1955. The variation of the general circulation in such an occasion was investigated by JALU²⁾ depending on his analysis of the weather maps which he had made when he had participated in the Research Expedition Team of Kuergelen Island in 1949-1950. VOWINCKEL³⁾ too, pointed out about the

general circulation of January 1951 over the Indian Ocean that in the first half it was characterized by high index (index is shown by pressure difference between 30°-55°S within 30°-90°E) while after 13 Jan. the high pressure cell deviated to the south, and blocking situation was intensified. In the southern hemisphere too, as is written above

a great change in the general circulation occurred as in the northern hemisphere.

6. Conclusion

a) In January 1959, the Subtropical High Pressure along 70°E meridian in the Indian Ocean was stronger than in 1958 and extended to south and the low pressure zone around Antarctica deviated to south considerably.

b) In January 1959, the general circulation in the southern hemisphere was characterized by the meridional circulation until 25 Jan. from the southern Atlantic to the South Indian Oceans and cyclones were apt to move SE-ward and came near Syowa Base. Owing to this, the Soya observed lower pressure than in January 1957 and 1958, and the weather was very poor in the area where the Soya was.

c) It seems that the general circulation changed to the zonal one with the strengthening of the Antarctic Anticyclone from the end of January 1959. The low pressure zone near Antarctica deviated to northward and situated between 50°~60°S with the movement of cyclone E. or ESE-ward, thus bringing good weather around Syowa Base.

References

- 1) J. C. Langford (1957): Southern Ocean Analysis with Special Reference to the Period December 1954-March 1955. Australian Met. Mag., No. 16, 1~22.
- 2) R. Jalu (1952): Mission aux Iles Kerguelen 1949-50, Rapport Préliminaire. Mémorial de la Météorologie Nationale, No. 37.
- 3) E. Vowinkel (1952): The Southern Hemisphere Circulation Jan.-March 1951. Notos, 1, No. 1, 18~22.