

Weather and Weather Forecasting in Lützow-Holm Bay and at Syowa Base

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昭和基地および、リュッツォウホルム湾の 沖合の天気とその予報について

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氷海における宗谷の行動および、船から基地への空輸などのオペレーションに対する協力の立場から、南極地域夏季の気象を綜観的に解折した。

宗谷が主として行動する流氷域北縁附近を境として、流氷域内外の天候は大に異なり北方は悪天候、南方は好天気のことが多いので、流氷域外の

予想が適中すれば 90% まで空輸成功が期待できる。流氷域外の天候予想について、悪天候を来す場合の気圧配置の特徴、悪天候から好天に転ずる場合の気圧配置、中緯度高気圧発達の場合、極高気圧発達の場合、気圧配置の周期、その他特異な天気状況などについて調査した結果を報告する。

Introduction

Weather forecasting operation carried out on board the Soya, the Japanese Antarctic Research Expedition Ship, had two objectives. Namely, the one was for the safeguard of the ship itself, and the other was for the safety of the airlift operation of materials and the wintering members from ms Soya to Syowa Base.

The forecasting could be divided into three categories, namely,

- (1) the long-range forecasting for the coming 10-20 days (issued weekly),
- (2) the one-day forecasting (issued daily), and
- (3) the forecasting for a sudden, severe weather change (issued on optional basis).

In order to carry out the above forecasting, we made surface and upper-air maps. Because of the shortage of available upper air observations, the upper-air maps were used only for information purpose.

1. General synopsis of the weather

Generally speaking, weather is very changeable in the vicinity of Syowa Base and its offing in summer season. Moreover, weather conditions are somewhat different between Syowa Base and its offing (Boundary of the pack ice in these waters is located at about 67°S.). We often experience a persistent good weather in the vicinity of Syowa Base, because of the rather direct influence of the Antarctic High. However,

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contrary to such conditions, rather unstable weather prevails in the offing. Therefore, from the outside area of pack ice where we usually anchor, it is considerably easy to fix the flight days of airlift from the ship to Syowa Base. We may say the scores of such forecasting under the said conditions were 90%. The residue of 10%, which is the so-called "uncertainty factor" was the effect of a front located in-between of the ship and the base. If the flight in the offing waters was possible and favourable, then, we were able to carry out the air-lift operation with 90% certainty.

2. Weather forecasting outside the pack-ice

If the flight condition outside of the pack ice becomes possible, then, as stated above, the air-lift becomes possible with the 90% certainty. Therefore, to begin with, explanation of the weather charts for the offing waters is given.

a. Typical pressure pattern from which bad weather is usually expected

As shown in Fig. 1, a low is approaching to the area of 60°S, 40°E. A broad

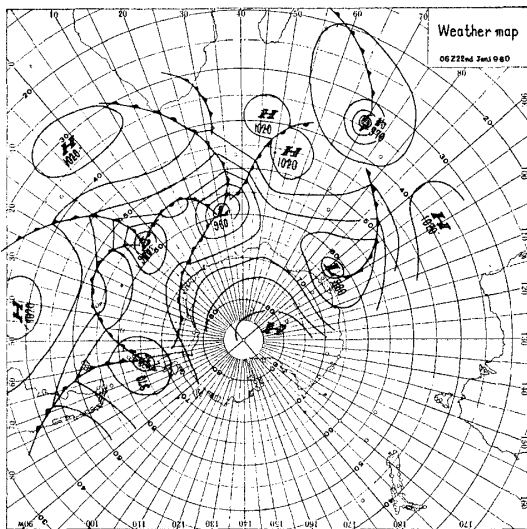


Fig. 1.

high pressure wedge is extending from Enderby Land to the Southern Indian Ocean. It should be noted that this belt of high pressure is almost stagnant. The Antarctic high is shifted its position a little bit to the east. Accordingly, a high to the south of Syowa base is weakened. The above situation is favourable for the lows approaching to the coast of Antarctica.

Sometimes, the lows are stationed in the offing of Syowa Base, and they change their courses to the west along the coast. Because of these situations, in the offing waters, we often observe storms which continue for some days. In the vicinity of Syowa Base, when such condition is once formed, it usually shows with strong storm and very low visibility. However, a period of stormy weather is prolonged as the distance from the coast is increased, consequently, an intermittent fair weather is seen at the base. It could also be said that under such conditions, the successive attack of lows from the Southern Atlantic is expected. Therefore, bad weather lasts for about ten days until such persistent weather pattern breaks up. Weather sometimes becomes fair between the short period of a low and the succeeding low. But in this case, the resulted good weather does not last even for a day. At Syowa Base, such fair weather lasts half a day or a day. If this stage or pattern changes, then the condition becomes such as shown in Fig. 2.

b. Typical pressure pattern when the bad weather is changed into fair weather

Fig. 2 shows a succeeding situation of the pattern as shown in Fig. 1. The

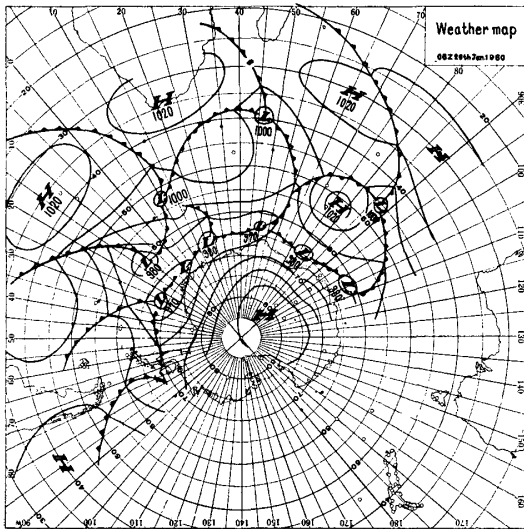


Fig. 2

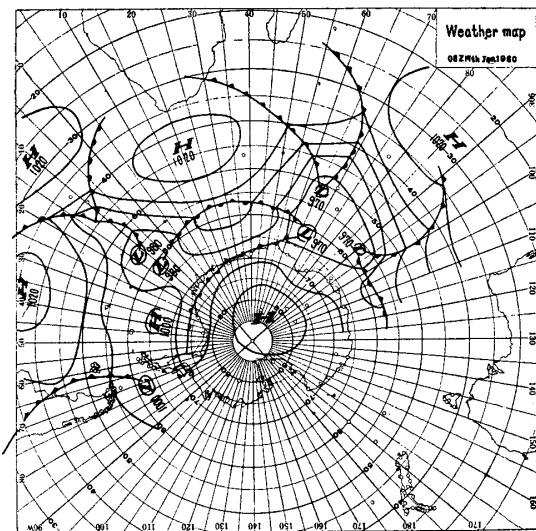


Fig. 3

Syowa base, the weather is rather good and cumulous type clouds are frequent. However, in the very vicinity of the stationary front, the weather is bad with abundant clouds and with frequent fog. Suppose we are just in the vicinity of the front, we can expect good weather in accordance with the north-south shift of the front, however, at the same time, abrupt change of weather into bad one is also expected. Special care is necessary in such case because the bad weather is accompanied by snow showers and slets, causing aircraft icing. Under these conditions, any operation is dangerous. Though it is fine in the vicinity of the ship stationed in the offing, there is a big possibility of bad weather en route from the ship to the base. Dangerous icing and fog are also present in the route.

d. The case when the Antarctic High is intensified

In Fig. 4, a case is shown in which the Antarctic High (continental high) becomes

Antarctic High and the Middle Latitude High are separated each other by a low pressure belt which extends in E-W direction. It is often observed that the weakened lows are often included in this belt of low. In this case, weather at Syowa Base becomes good but, at the same time, easterly winds prevail. Consequently, low level clouds spread all over the sky and visibility becomes reduced. Though such weather is not a recommendable condition for flight, but the short range reconnaissance flight is permissible. As the derived conditions from the one shown in Fig. 2, we may mention two types. The motive of such change is fully depends upon the balance of powers of the Antarctic High and the Middle Latitude High.

c. The case when the Middle Latitude High is intensified

Speaking of Fig. 3, this case is frequently seen from the end of December to the middle of January. The Antarctic High is weak, and the Middle Latitude High is strongly extended southward and then in between of these highs, a stationary front is established and it often reaches down to Syowa station. In the outer ocean inclusive of the offing of

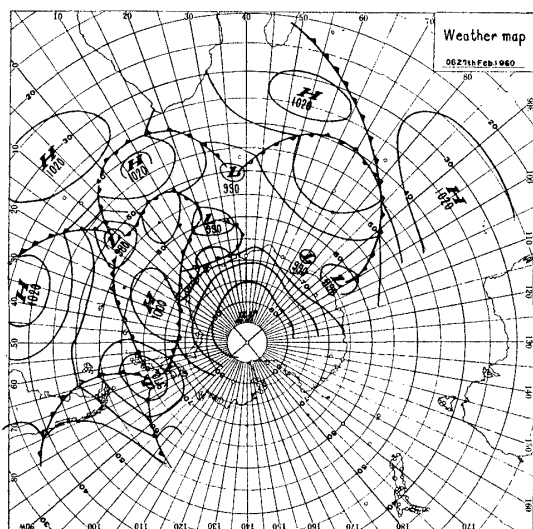


Fig. 4

Such condition lasts until the Antarctic High becomes weak or until the high moves eastward. Actually, the movement of the Antarctic High is very slow, then, such condition often lasts for about a week or even to 10 days.

Under such circumstances, airplane flight operation is able to be carried out without any danger. However, during the night, there is a possibility of the radiation fog formation because of the decrease of air temperature. Such fog usually dissipates in the morning, therefore it is not necessary to pay special attention for it.

e. On the persistence period of a pressure pattern

The sequence of pressure pattern changes are shown in Figs. 2, 5 and 4 in order.

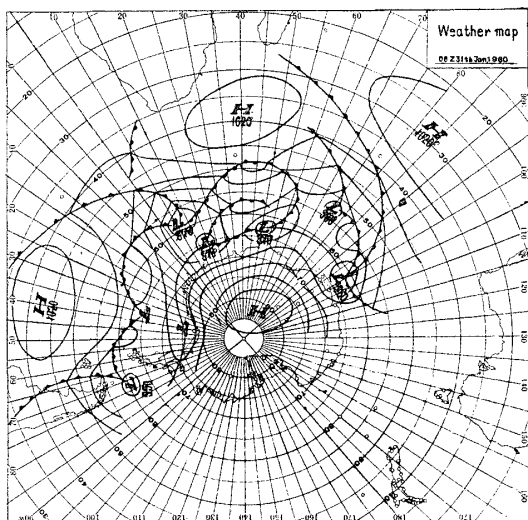


Fig. 5.

Antarctic High. The change needs 3-5 days from the situation shown in Fig. 3 into that shown in Fig. 4. Therefore, about seven days are necessary from the bad weather situation (Fig. 1) to fair weather situation (Fig. 4). In other words, about two weeks

strong and comes to the said waters from the west. This pattern prevails from the end of January to February. The Antarctic High spreads to the latitude of 65°S . The lows which come from Gough Island area take the path southwards along 0° Greenwich meridian, or they often move to east along the latitude line of 55°S . Because of such pressure distribution, both of Syowa Base and the offing are covered by the Antarctic High. Both of them are not to be affected by lows which pass far northern area. Consequently, it is usually very fine and we can expect a very good visibility.

In Fig. 5, the southern part of the Weddell Sea is covered with the Middle Latitude High and it moves towards east. The similar situation is expected when the situation changes from that shown in Fig. 2 into that of Fig. 3. However, in the succeeding stage, the activity of the Antarctic High determines the situation whether it develops into a condition as shown in Fig. 3 or in Fig. 4. In order to follow up the sequence, it is necessary to utilize the data at Amundsen-Scott base at the South Pole, and the data of Vostok. From these data, we can distinguish and/or estimate the changes of the

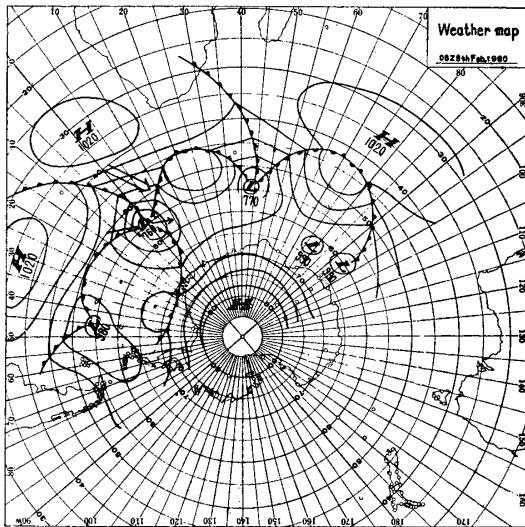


Fig. 6

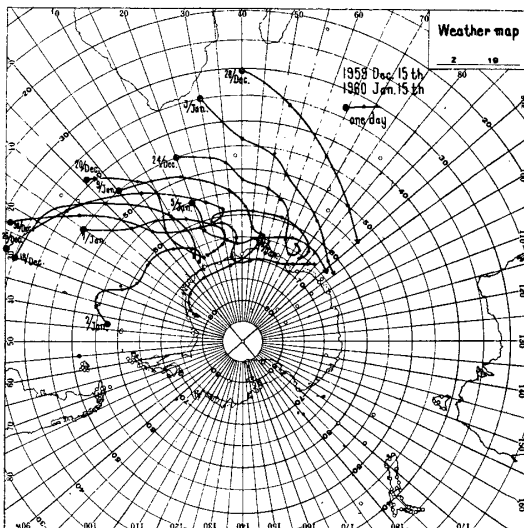


Fig. 7

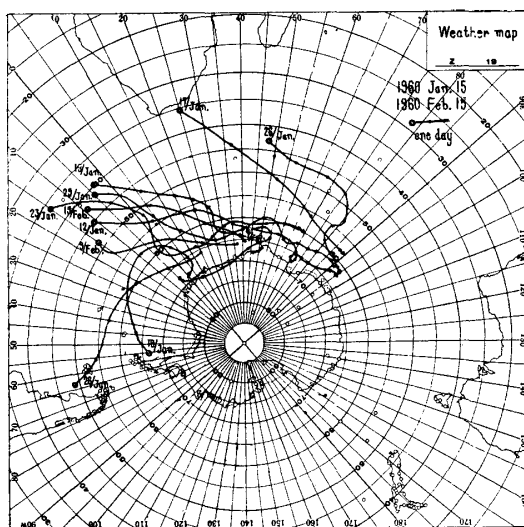


Fig. 8

is necessary from a bad weather condition to the next bad weather. It is therefore, concluded that the period of fair weather is about two weeks.

f. Particular weather

In addition to the above stated general weather situation, we often encounter a very particular bad weather of very short duration. The situation is brought about by a small cyclone coming down from the Prince Olav Coast of Enderby Land to Syowa Base. The accompanied storm which is moving westward also brings about 40-60 knots winds for about a couple of hours. Though its duration is short, the wind velocity is so high, that we can not disregard its potentiality. We have to be very careful for this sort of storm, because the prediction of it is very difficult owing to the shortage of the necessary data.

g. On the swells which come to the offing of Syowa base

The fact whether the swells present or not within pack-ice area is very serious for small size ships. Let us consider in what case the swells deeply penetrate into the pack-ice area.

Generally speaking, if the swells come into the pack-ice, their heights become gradually lower, and the short period swells are vanish out. Eventually, there remains swells having considerable heights and long periods within the pack ice area. Their periods are of 12-16 seconds.

Therefore, in order to grasp the nature of such swells, we have to find out a generating area of swells of large wave height and long period. In order to do so, we have to examine the area where the

Middle Latitude High is located 10° - 30° E, and winds of N-NW continuously blow. To find a cyclone which is coming directly to Syowa Base is also necessary. Then from these available data, we can calculate the force of the strong NW wind. In Fig. 6, a cyclone which reaches the Prince Olav Coast from 0° is shown. Next day of the date of this map, we observed swells at 30 miles within the pack-ice area.

In Figs. 7 and 8, the tracks of cyclones in the waters off Syowa Base are shown. General synopsis of some typical pressure patterns are shown, but we have to note here that these are the averaged or normal conditions and the "season" itself is shifted according to the particular year.