

Studies on the Seasonal Weather Forecasting (V, d)

— On the Relationship between 5-day Mean 700-mb Anomaly Chart
and the Surface Pressure Pattern —

by

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Abstract

This paper is a study on the relation between the surface weather maps and the standard types of 5-day mean 700-mb anomaly charts. 5-day mean anomaly charts on the 700-mb height and the weather change on the surface are closely correlated, and the frequency of the weather types on the surface for each of the standard types of 5-day mean 700-mb anomaly charts is obtained. And the movement of cyclones, typhoons and migrating anticyclones is described for the 700-mb anomaly charts.

1. 5-day mean 700-mb anomaly charts and the corresponding weather types on the surface

According to our former report, a good correlation obtains between 5-day mean 700-mb anomaly and the simultaneous anomaly of the surface pressure. Therefore, 5-day mean 700-mb anomaly charts are similar to those for the surface. This is confirmed by the present research.

In Fig. 1, some examples of the composite map for the typical pattern of 5-day mean anomaly chart are shown for both 700-mb and the surface. We see from this that the upper and the surface anomaly charts are very similar.

Next, the frequency of weather types on the surface for each standard type of 5-day mean 700-mb anomaly charts is obtained as in Table 1, where the weather type of typhoon means those in which the typhoon occurred on the Japan Island, and it is sometimes very difficult to distinguish the North High type from the weather type of the migrating anticyclone. The frequency of 0.5 means that the weather continued for the first half or the second half of the 5-day in question. As to the standard types of anomaly charts, the readers are referred to Dr. K. TAKAHASHI and M. IIDA's paper in this volume.

From Table 1, we see the high correlation between the 700-mb anomaly pattern and the weather types on the surface. These are as follows:

- a) West High and East Low is apt to occur in W_1 , W_2 , W_4 and B type.
- b) Bai-u type occurs in B, R_1 , R_2 and W_2 type.
- c) South High and North Low occurs in S_1 , C_2 type.
- d) North High type occurs in B and L_1 type in Fall, H_1 and H_2 in summer

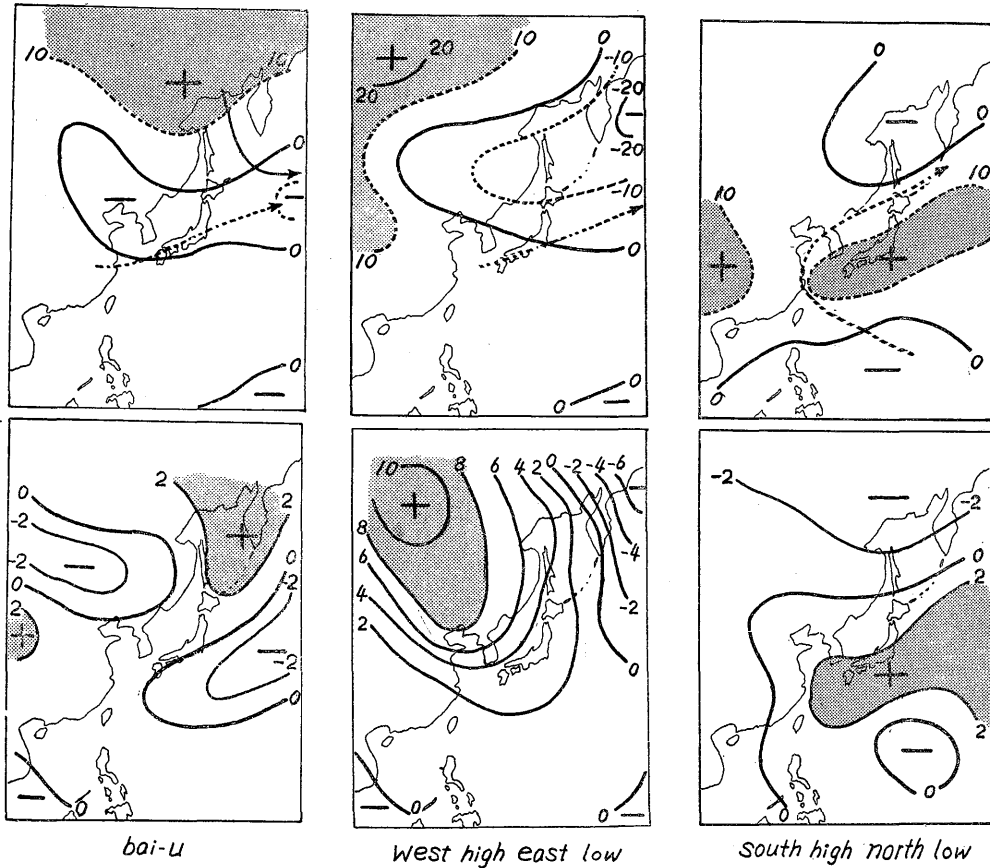


Fig. 1. Composite map of 5-day mean 700-mb anomaly (upper charts) and surface pressure anomaly (lower charts) for the typical weather types on the surface. The contour is drawn for every 10 feet and 2-mb for 700-mb level and the surface respectively. Full line and dotted line show the mean path of anticyclones and cyclones respectively.

and winter.

e) Migrating anticyclones are apt to appear in T, Z, H₁, R₂, W₂, W₃, W₄ and E₂ type.

f) Typhoons often pass near Japan in C₂, S₁, S₂ and C₁ type.

Brief explanation of the surface pressure in the above follows :

West High and East Low : The typical pressure distribution in winter. This is characterized by the Siberian High and the Aleutian Low, the north-west monsoon blows from the continent to Japan.

Bai-u type : This is characterized by the Okhotsk High and the frontal zone off the south coast of Japan.

South High and North Low : The typical pressure distribution in summer. The southerly from the Ogasawara High prevails in Japan. The weather is fine and temperatures are very high.

Table 1. Frequency of the weather types on the surface for each of the standard type of 5-day mean anomaly charts.

Surface 700-mb	West High and East Low	Bai-u	South High and North Low	Migrating anticyclone	North High	Typhoon	Unknown
T ₁	0.5	0.5	—	2.5	2.5	—	2
T ₂	1	—	0.5	10	—	—	3
Z ₁	0.5	1	—	9	2.5	—	—
Z ₂	—	0.5	0.5	5.5	1	1	1
H ₁	—	2.5	1.5	5.5	0.5	—	1
H ₂	—	1.5	0.5	1.5	1	—	1
R ₁	—	2.5	—	2	1	—	1
R ₂	—	7	—	4	—	—	2
C ₁	—	2	1	1	—	1	2
C ₂	—	1	3	1	—	—	—
L ₁	1	1.5	—	2	1.5	—	4
L ₂	1	1	—	1.5	—	—	1
S ₁	—	—	5.5	—	—	—	—
S ₂	0.5	1	—	—	—	5	—
B	5	19.5	0.5	3	1.5	—	2
W ₁	5.5	1	—	1	—	—	—
W ₂	2.5	2	—	2	—	—	—
W ₃	—	—	—	3	—	—	—
W ₄	2.5	—	—	3.5	—	—	2
E ₁	1	—	—	2	1	—	5
E ₂	—	—	—	3	1	—	4

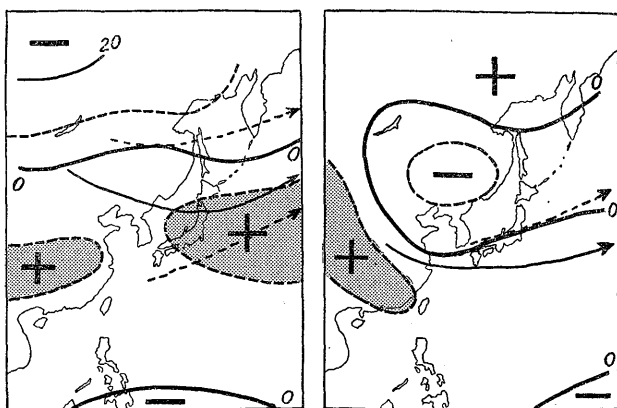


Fig. 2. Composite maps of 5-day mean anomaly chart for the type of migrating anticyclones both on 700-mb level and the surface. Contours are drawn for every 10 feet.

A and B are the cases in which the migrating anticyclone moves along about 40°N and 30°N latitude circle respectively.

2. Relation between 5-day mean 700-mb anomaly charts and the migrating anticyclone

In the section above, only the types of the pressure pattern are referred to. Further research has been made on the migrating anticyclone.

Migrating anticyclones in Japan appear in spring and Fall, and it is known that there are two predominating paths of the movement near Japan. One of them is along 40°N latitude and the other is about 30°N latitude. In the former case,

the frontal zone stays off the south coast of Japan and it is rainy. This is called North High type. In the latter case, it is generally fine and the temperatures are higher than normal.

Fig. 2 A, B are the composite maps for both types of migrating anticyclones. They show that the position of the ridge line of the high belt lies about 10°N lat. north for the former case as well as does the zero line of contour in 700-mb anomaly charts.

3. Relations between 5-day mean 700-mb anomaly charts and the movement of cyclones and typhoons

It is clear that an intimate correlation exists between the anomaly pattern and the movement of cyclones. However, the relationship is complicated and we have few examples of synoptic analysis of this problem.

However, the following brief summary will be useful for the purpose of practical seasonal weather forecasting.

- a) Cyclones move generally in the area of negative anomaly in summer.
- b) In T_1 , T_2 type, single cyclones move along about 50°N latitude circle and coupling cyclones move along Japan Island.
- c) Cyclones are apt to move slightly to the east in the zone of strong westerly wind in anomaly charts and moves sometimes in the high belt of anomaly chart in Z_1 and Z_2 type. This may be explained by the steering of the upper air current.
- d) Cyclones do not move in the area of positive anomaly in high latitudes.
- e) In the case of the weather type of the migrating anticyclone, cyclones move in the belt of westerlies of the high belt of anomaly charts.
- f) Typhoons move around the area of positive anomaly which represents the development of the Ogasawara High.
- g) The area of negative anomaly in low latitudes shows generally the existence of the typhoon and this is proved by Table 2.

Table 2. Existence of the typhoon and the area of negative anomaly in low latitudes.

	Anomaly is negative, typhoons exist	Anomaly is positive, typhoons exist
Spring	10/22=46%	0/23= 0%
Summer	23/27=85%	5/21=24%
Autumn	31/32=97%	6/17=35%
Winter	13/20=65%	2/30= 7%

h) Typhoons move westwards when the area of negative anomaly is zonal. When the area of negative anomaly stretches to the north, typhoons move in that direction.

i) When there is a trough of negative anomaly from north to south, the typhoon moves in the area of negative anomaly before recurvature and after that turns its course a little to the right and moves into the area of positive anomaly.

j) Typhoons often land in Japan when an area of negative anomaly exists near Kyūshū.

k) Cyclones are apt to develop in C_1 , E_1 , T_2 and some cases of B and Z type, where the cyclone development is defined by the 20-mb or more decrease of the central pressure in a day, or an appreciable enlargement of the area of a cyclone. In these types, there is generally an area of large positive anomaly in high latitudes and a negative one in the vicinity of Japan or in low latitudes. This may be explained by the meridional mixing of the air by the developed cyclone.

References

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