Shorter Contributions

Estimation of Direction of Air Flow from Observation of Rime Ice

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As Asahikawa City is situated in a basin in Central Hokkaido and the Ishikari River and many tributaries flow through the city, fog frequently occurs in the city and the surrounding area. In the course of the study of radiation fog an attempt was made to determine the areal distribution of wind direction when the fog occurred. However, in the fog the wind is usually weak and erratic, so it is difficult to find the main wind direction by ordinary method. When the air temperature is below freezing in winter, supercooled fog droplets striking upon the branches of trees form beautiful rime on the windward side of the branches. Therefore the direction of air flow can be estimated from the direc-

tion of the rime formation. In the mornings when rime ice was formed we went round in the city and the surrounding area by car or bicycle and measured the direction and length of the rime. As the rime extension depended on the thickness of the branches, we only observed the rime which was formed on the twigs of diameters about 3 mm.

The observations were made in the mornings of January 17, February 5, 15, 22 and 26 and March 6 in 1956. Fig. 1 (a) and (b) show the results of observations on February 15 and 26 respectively. On February 15 the observation was made only in the western part of the city. In the figures the arrow indicates the estimated direction of air flow

Fig. 1(a). February 15 (1959)

A.M.O.: Asahikawa Meteorological Observatory

Urban area Hill

Fig. 1(b). February 26 (1959)

and the numeral by the arrow is the length of rime in mm. On February 26 the rime was partially broken at some places, so that we could not measure its length there. The figures show that the air flow converges toward the center of the city. The observations on the other four days also show the similar pattern of air flow.

Asahikawa is a middle-sized city with its population of about 190,000 and in winter

many houses, buildings and factories consume a large amount of coal for heating and other uses. Table 1 shows the minimum air temperatures at Asahikawa Local Meteorological Observatory and Nagayama and Nishikagura Climatological Stations in the mornings when fog occurred. Asahikawa Observatory is located in the center of the Asahikawa City. Nagayama and Nishikagura Stations are in the country at a distance 7 km north-west and 9 km south of Asahikawa respectively. These stations are at about the same height as Asahikawa Observatory.

The table shows that except one case (January 17, Asahikawa -16.0°C and Nishikagura -14.0°C) the minimum air temperature is higher at Asahikawa than at the other two stations, particularly between Nagayama and Asahikawa temperature difference of as much as 4°C is frequently found. Between Asahikawa and Nishikagura the difference is not so pronounced. The Nishikagura Station is situated on a hill with height of about 30 m and is surrounded by the forest, so that the station would be somewhat protected from cold air. Then it is supposed that as the air temperature is higher in the city than in the country in the calm

Table 1. Minimum Air Temperature ($^{\circ}\text{C}$).

Date (in 1959)	Asahikawa	Nagayama	Nishikagura
Jan. 17	-16.0	-20.5	-14.0
Feb. 5	-13.9	-16.2	-16.9
Feb. 15	-18.9	-22.9	-20.0
Feb. 16	-16.9	-20.7	-18.1
Feb. 22	-9.8	-13.4	-11.8
Feb. 26	-17.9	-20.4	-20.0
Mar. 6	-8.4	-12.2	-9.0
Mar. 7	-11.7	-15.1	-14.0
Mar. 10	-12.4	-16.3	-14.4
Mar. 13	-8.8	-11.1	-9.8
Mar. 27	-1.5	-2.9	-3.5
Mar. 28	0.2	0.0	-0.5
Mar. 30	2.0	0.7	0.5

morning local circulation sets in and we observe it as a convergent current on the ground.

Several phenomena were also found. In the city only the thin film of rime was formed nearly uniformly around the twigs. It indicates that as the air temperature in the city is higher than in the surrounding area the evaporation of the fog droplets flowing into the city would occur and the wind would be erratic in the city. Fig. 1(a) and (b) indicate that there seems no significant regional difference of the rate of the rime growth.

It is well known that in winter thick steam fog is formed on the river, but our observations indicate that the extension of the rime on the hill with height of about 50 m and on the plain snow-covered area is nearly as much as that near the river-side. It suggests that when radiation fog develops the effect of river steam is small.

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樹氷を用いた都市内外の気流調査

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