

HISTORICAL WEATHER RECORDS AT HIROSAKI, NORTHERN JAPAN, FROM 1661 TO 1868

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Reconstruction of historical climate by old diary

The personal or official diaries are effective to reconstruct daily weather in historical age. By using these weather records in the diaries, historical climate of a certain location can be reconstructed, and further synoptic weather condition is to be assumed if the weather descriptions of the same day for sufficient locations are available.

There have been many diaries since the monarchic age of Japan. Old diaries in which weather was noted were listed (Yamamoto *et al.*, 1982). Some of them has been published already (ex. Kikushima, 1981). "*Hirosaki Hanchô Nikki*" is one of the most valuable old diary. Hirosaki is an old city located in northernmost Honshu Island. The diary was an official document of the feudal clan Tsugaru. Its weather description covers 200 years from 1661 to 1868. And the weather had been described in the same format.

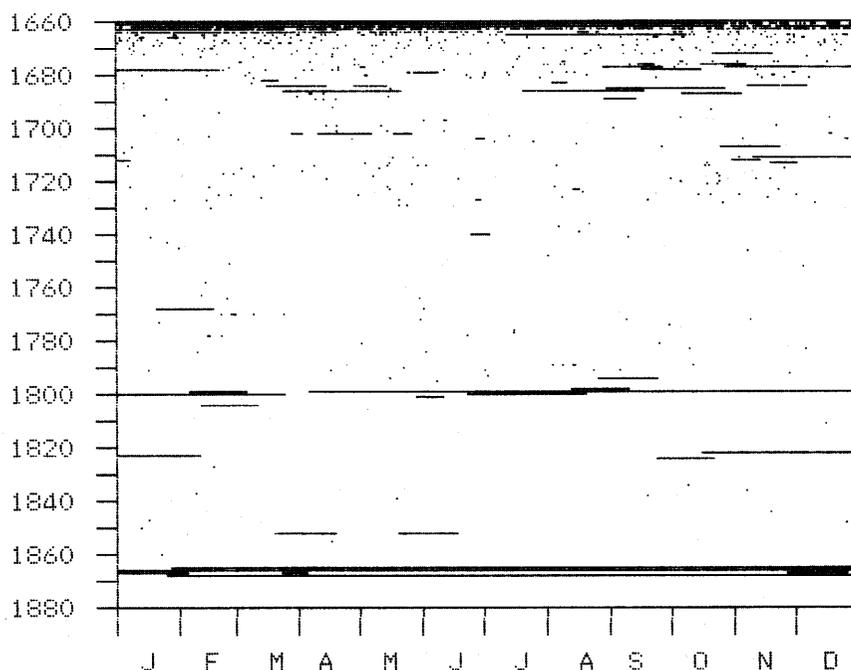


Fig. 1 Missing dates of weather record in the diary at Hirosaki from 1661 to 1868

Processing of weather descriptions in "Hirosaki Hanchô Nikki"

The weather descriptions were processed to know the climatic change at Hirosaki in the historical age. The weather was categorized to several types with priority of precipitation phenomena. The weather records were processed and arranged as follows: Daily weather was classified and expressed by using symbols as six main weather types combined with eight remarks (see legend). The date in the old Japanese lunar calendar was converted in the Gregorian calendar. All data were recorded and kept as a computer file.

Characteristics of the weather record

These records cover from 1661 to 1868 continuously except starting and finishing year (Fig. 1). Almost perfect records within two missing days in a month, were accumulated over 190 years. There were rather long missing records around 1800, but this deficiency is not essential for statistical analysis. Rainy days in broad sense including heavy rain, rain, light rain and snow, appear continuously all over the period in the same mode (Fig. 2).

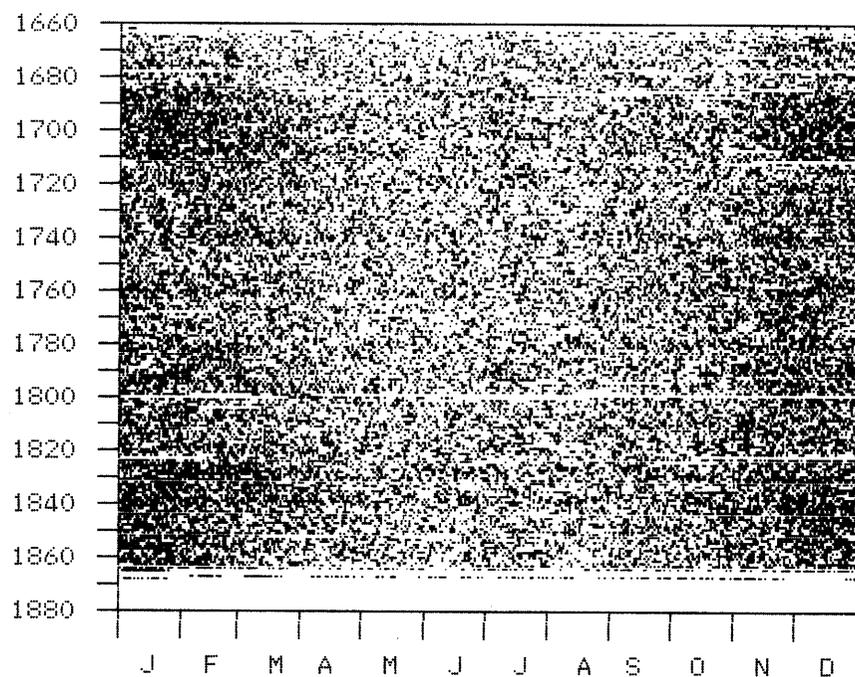


Fig. 2 Dates at which rainy days, including "heavy rain", "rain" and "light rain", were recorded in the diary at Hirosaki from 1661 to 1868

"Hirosaki Hanchô Nikki" ended before the beginning of instrumental observation at Hirosaki. Then weather records can not be compared with the data obtained by modern observation. However, mean monthly occurrence frequency of precipitation in the historical age was almost equal to that of rainy day with daily precipitation more than 1 mm (Table 1). The difference ranges within 2%. Occurrence ratio of "clear" day and "cloudy" day had

Table 1 Mean monthly percentage frequency of weather types at Hirosaki during the period from 1661 to 1868

cf. Main weather types (above) were often described with remarks (under). Then, total frequency is over 100%.

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANN
○	27.0	33.0	39.9	49.6	54.9	54.2	50.7	57.7	46.8	43.0	29.7	25.4	42.7
@	9.3	8.0	10.7	10.3	10.2	11.7	11.2	7.1	10.3	10.1	11.1	10.8	10.1
■	0.1	0.1	0.3	0.2	0.1	0.2	0.5	0.5	0.5	0.8	0.5	0.2	0.3
●	4.8	4.4	13.2	22.3	19.8	17.6	19.8	16.5	23.6	33.3	31.4	14.1	18.4
·	2.0	2.0	4.0	8.7	14.4	16.1	17.8	18.1	18.7	10.7	7.4	3.8	10.4
*	56.8	52.4	31.9	8.6	0.4	0.0	0.0	0.0	0.0	2.0	19.7	45.5	18.0
t	0.8	0.8	1.1	1.3	2.2	2.7	4.2	5.2	3.3	5.7	4.4	1.9	2.8
h	0.1	0.2	0.4	0.6	0.2	0.0	0.0	0.0	0.0	0.5	1.1	0.4	0.3
f	0.0	0.0	0.0	0.1	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1
m	0.0	0.1	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
r	0.1	0.2	1.3	3.6	0.5	0.0	0.0	0.0	0.1	3.3	4.3	1.0	1.2
w	5.0	4.8	3.3	1.9	0.6	0.0	0.0	0.0	0.2	0.5	1.6	3.0	1.8
c	1.5	1.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.3

been changed irregularly for the two centuries. This means that identification criteria of “clear” and “cloudy” might have been different among the observers in the old times.

References Cited

- Kikushima, N. (1981): *Kôfu o chûshin to shita Tenkôhyô (Weather Table around Kofu)*.* Kofu, 221p.
 Yamamoto, T., Fukaishi, K., Maejima, I., Mizukoshi, M., Yoshimura, M., Shitara, H., Urushibara, K., Hayashi, Y. and Kurosaka, H. (1982): *Kokikô fukugen ni riyô dekiru Nikki・Ryokôki nado no chiiki betsu Mokuroku [I] (List by areas of diary and travel book, etc. which are useful for reconstructing old climate [I])*.* *Climatological and Meteorological Report, The University of Tsukuba*, 5, 60–82.

(* in Japanese)