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Reconstruction of July Temperature Variations since the 1830s in Kawanishi Based on Historical Weather Documents

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In the present study, we estimated the July maximum temperature variations from 1830 to 2011 in the town of Kawanishi in the southern part of Yamagata prefecture using daily weather reports and observations documented in an old personal diary. Using historical weather reports, we computed the number of "fine-weather" days for each July during the study period. Then, July maximum temperatures in Kawanishi were estimated using a simple linear regression analysis based on the relationship between the July maximum temperature and number of "fine-weather" days, computed from historical weather reports. By comparing the time series of estimated temperatures with those of historical instrumental temperature data in the late 19th century, we found that the variation in the estimated temperature correlated well with that of the instrumental temperature data. This indicates that the estimated results in the present study are highly reliable. The results of this analysis showed that there were cool periods in the 1830s, 1860s, 1900s, and a period extending from the 1980s to the early 1990s. Those cool periods in the 1830s, 1860s, and 1900s coincided with poor rice harvests and severe famines in northern Japan. Warm summers were observed in the 1850s, a period extending from the 1870s to 1880s, and 1920s. We found that temperatures in the early 1850s were similar to those of warm summers in the late 20th century.

Key words: historical diary weather records, climatic reconstruction, July, temperature variations

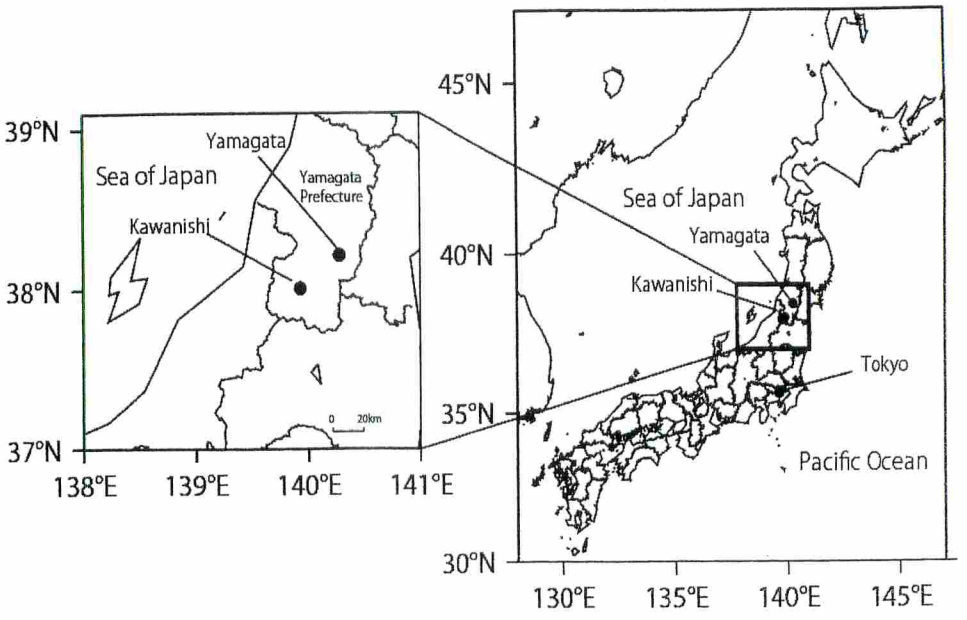

Fig. 1 Location of Kawanishi where Takeda Genemon's diary was written

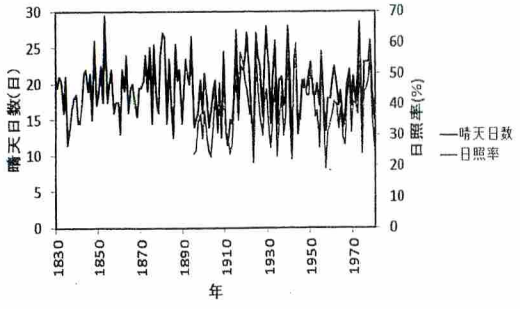

Fig. 2 Comparison between the number of "fine-weather" days in July recorded in "Takeda Genemon's diary" and rate of sunshine observed at Yamagata Observatory

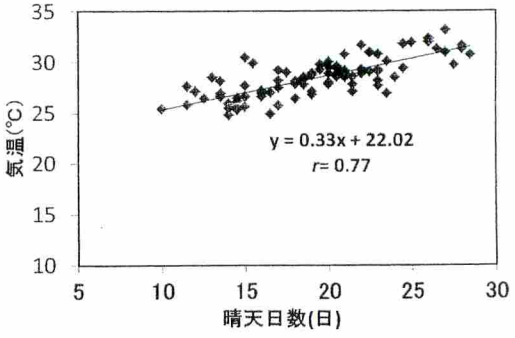

Fig. 3 Relationship between mean July maximum temperature in Yamagata and number of "fine-weather" days computed from Takeda Genemon's diary

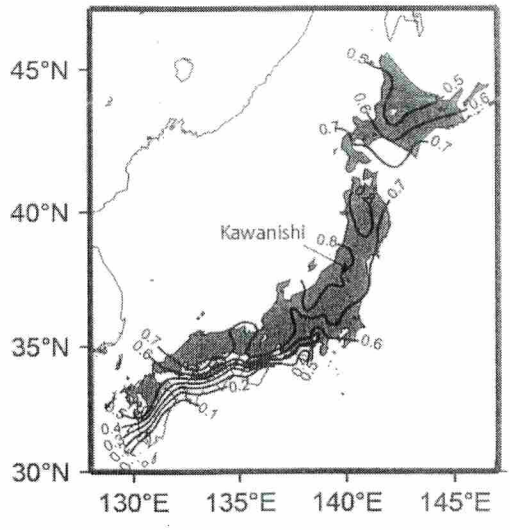

Fig. 4 Distribution map of correlation coefficients of the estimated July maximum temperature in Kawanishi and at other observatories
Gray area: significant correlation coefficients at the 5% significance level.

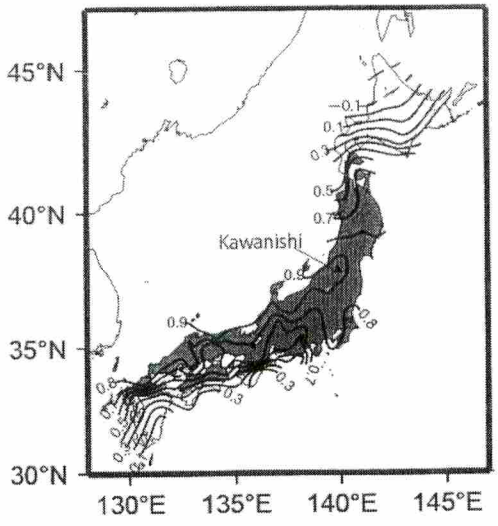

Fig. 5 Distribution map of correlation coefficients of the estimated July maximum temperature in Kawanishi and rate of sunshine at other observatories
Gray area: significant correlation coefficients at the 5% significance level.

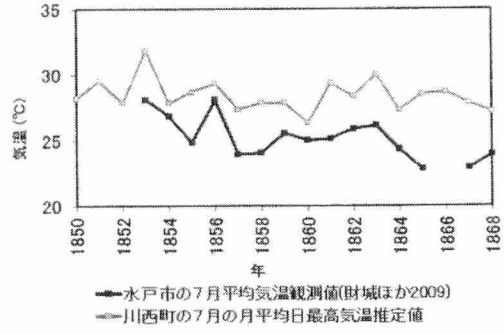

Fig. 6 Comparison between estimated July maximum temperature in Kawanishi and observed July mean temperature in Mito (Zaiki et al. 2009)

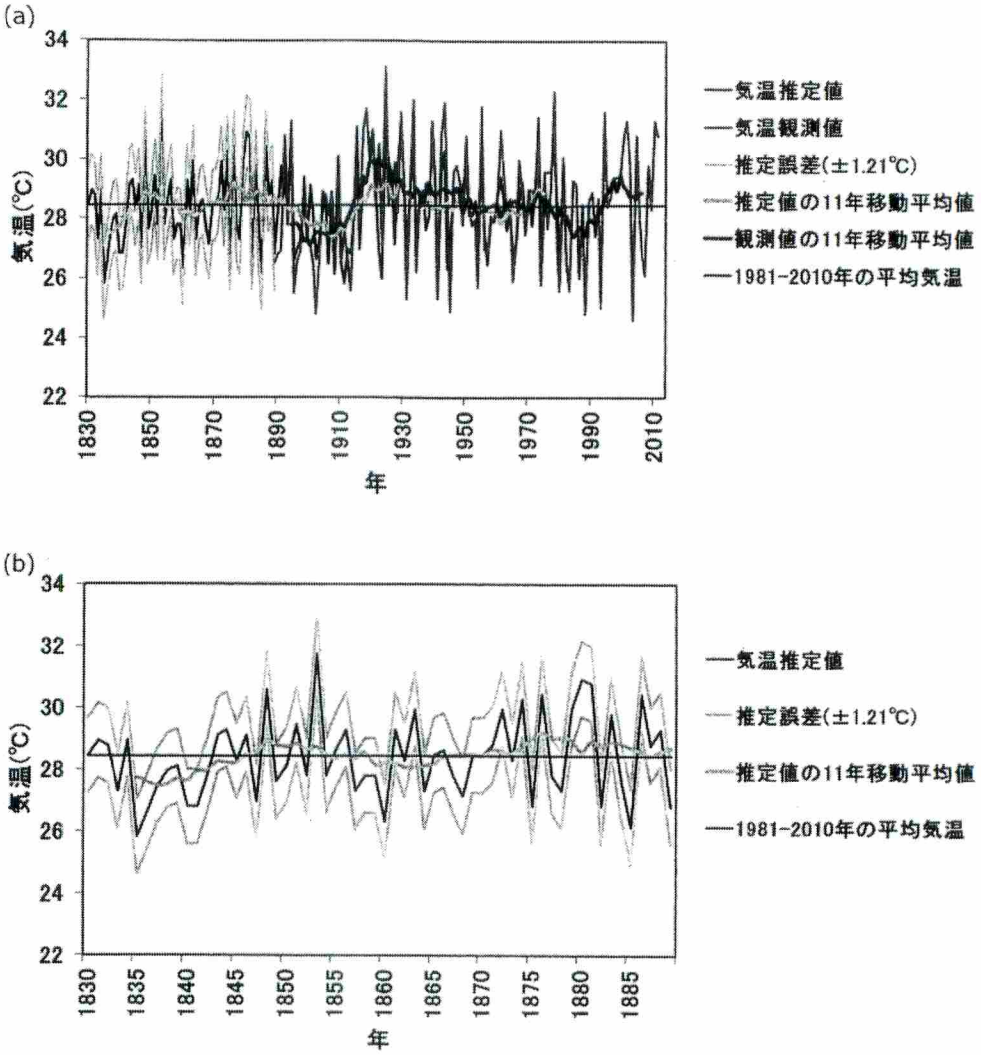

Fig. 7 Variations in estimated July maximum temperature in Kawanishi
(a) temperature variations for the period 1830–2011, (b) temperature variations for the period 1830–1889.

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