EMS Annual Meeting Abstracts
Vol. 16, EMS2019-248, 2019

Fluctuations of global solar radiation in Japan from 1821 to 1850 including the severe Tempo famine as estimated from historical weather records

Mika Ichino (1), Takehiko Mikami (2), and Kooiti Masuda (2)

(1) Center for Open Data in the Humanities, Joint Support-Center for Data Science Research, Research Organization of Information and Systems, Tokyo, Japan (m_ichino@nii.ac.jp), (2) Tokyo Metropolitan University, Hachioji, Japan

Many historical diary documents in Japan include daily weather records. To reconstruct historical climates from daily weather records, Ichino et al. (2001) constructed a method for estimating global solar radiation based on daily weather conditions. They have suggested that the global solar radiation is strongly related to the weather conditions. We made an attempt at reconstructing monthly mean global solar radiation from 1821 to 1850 based on the weather records described in 11 historical diary documents, with special attention to the records in the year 1836, when a severe famine occurred. Global solar radiation is an important factor for the energy balance of the Earth, and is also fundamental to the hydrological cycle and agricultural productivity. This implies that reconstructing global solar radiation involves investigations into climatic physics and historical human societies.
The estimated monthly means of global solar radiation in 1836 are compared to average estimations for 30 years (1821–1850), including the 1830s, at 11 points in Japan where data are generally available. According to our estimation, the values of solar radiation in July and August 1836 were smaller than their provisional normal values, which is the average for 30 years (1821–1850), at all points except for those in Tohoku and southern Kyushu regions, although these differences were not extreme. On the other hand, fluctuations during the 1830s were larger than other decades before and after. Moreover, the estimations in spring (February, March, and April) and autumn (September, October, and November) 1836 were not smaller than the average for 30 years (1821–1850). Likewise, all estimated monthly means of global solar radiation are compared to the average for 30 years (1821–1850), and there were lower values in several summer seasons. The characteristic of estimations in 1836 is that not only an anomalously low solar radiation in July and August 1836 but also low global solar radiation in the summer of 1836 (from May to September) had been ongoing, which might have been a key climatic condition affecting society in the famine year.

Reference

Ichino, M., Sakamoto, N., Masuda, K. and Mikami, T. (2001): The method for estimating global solar radiation based on weather records—Toward the climatic reconstruction in the historical period—. Tenki, 48, 823-830. (in Japanese)