

Estimation of global mean temperature using stable isotope ratios of tree ring cellulose in Yakusugi cedar

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The precise reconstruction of the past global mean temperature is extremely important to predict future climate. The best proxy to trace past global mean temperature is a sea level change. However, it is very difficult to reconstruct past sea level change with high time resolution. This study analyzed Yakusugi tree-ring d13C for the past about 1800years annually. Yakusugi tree-ring d13C is known to show similar pattern with sea level change. Tree-ring d13C is often generally show a positive correlation with temperature. Previous study has shown an apparent negative correlation with temperature (Kitagawa and Matsumoto, 1995). This study suspected the reason of a negative correlation between Tree-ring d13C and temperature is relative to the original meteorological feature of Yakushima. The meteorological observation and the measurement of growth of cedar in the field were conducted. This study performed to verify which climatic factors affect significantly Tree-ring d13C changes. As a result, Ishiduka region where the sample used in this study inhabited was extremely large amount of precipitation. Relative humidity was found to be almost 100% and to be very small changes. Because of short sunshine hours by precipitation and fog, we concluded the summer daylight hours had the most significant impact on the Tree-ring d13C fractionation. The apparent negative correlation between global mean temperature and carbon isotope ratios suggest that summer radiation was small in warm interval and in cold period, summer radiation was large. This can be explained by the strength of the Asian monsoon. In warm period, enhanced Asian monsoon carry a lot of cloud. The cold period can be understood as relative increase in daylight hours by this mechanism become weaker.

Keywords: tree ring stable isotope, climate change, Yakusugi, one year resolution