

## Current state of climate reconstruction from tree rings in Japan

# Koh Yasue[1]

[1] Forest Science, Shinshu Univ.

<http://karamatsu.shinshu-u.ac.jp/soshiki/shinrin.htm>

### 1. Dendroclimatology

Tree rings provide one of the best sources of proxy information about climatic change with annual resolution. During last 30 years, dendroclimatology has been applied to past climate reconstruction and made great contribution to understanding in past climate in many part of the world. The dense networks of tree-ring chronologies (ITRDB; International Tree Ring Data Bank) have been applied to the reconstruction of large-scale changes in climate <sup>1)</sup>. In contrast to the relatively dense networks of tree-ring records in Europe and North America, dendroclimatological studies are under progress in Asia, including Japan. Mitsutani et al. (1987) <sup>2)</sup> confirmed dendroarcheological potential in Japan, and following studies evaluated potential for dendroclimatic reconstruction <sup>3,4)</sup>

### 2. Climate reconstruction in Yakushima Island -A case study -

We tried to develop ring width and maximum density chronologies of Yakusugi (*Cryptomeria japonica*) trees that are known as one of oldest trees in Japan. A total of 126 cores were taken from 58 living trees at two sites located northern and southern slopes of the island (both are 1300 m a.s.l.). A large number of missing rings and wedging rings were found through cross-dating procedure. About a half of cores were cross-dated successfully. Three ring width chronologies and two maximum density chronologies of 251 to 1011 years were developed. The analyses on climatic responses revealed that the chronologies correlated positively with sunshine duration of the growing season. The transfer function for reconstruction of sun shine duration from May to June was successfully statistically verified by a standard dendroclimatological technique. The sunshine duration of monsoon season was reconstructed for past 248 years. The results suggest that the potential utility of tree rings of Yakusugi for reconstruction of Monsoon for past thousands years.

### 3. Future development of dendroclimatology in Japan

The difficulties exist in dendroclimatology in Japan to extract climatic signals from ring width series because of less stresses of moderate climatic conditions on radial growth and inclusion of disturbance signals in ring width series. Especially, it is difficult to reconstruct long term trend of climatic signals. The tree-ring density of annual rings, which can be obtained by densitometric analysis, has been recognized as important parameters for reconstruction of summer climate <sup>5)</sup>. The tree-ring densities seems to be suitable indicators to reconstruct decadal scale climatic changes. Nakatsuka et al. (2008)<sup>6)</sup> demonstrated that the ratio of stable oxygen isotope is one of most valuable indicator of relative humidity and rain falls having less effect of biological processes. Further development of tree-ring networks and application of sensitive tree-ring indicators to climate will make great progress in dendroclimatic reconstruction in Japan.

### 4. Literatures

1) Mann, ME. et al. (1998) Nature 392: 779. 2) Mitsutani, T. et al. (1987) Mokuzai Gakkaishi 33: 165-174. 3) Yasue, K. et al. (1995) Proceedings of IGBP-PAGES/ PEP-II Symposium on Palaeoclimate and Environmental Variability in Austral-Asian Transect during the Past 2000 Years: 138-143. 4) Yonenobu, H. et al. (2006) Geophys. Res. Lett. 33: L10701, doi:10.1029/2006GL026170. 5) Yasue, K. et al. (2000) Trees 14: 223-229. 6) Nakatsuka, T. et al. (2008) This volume

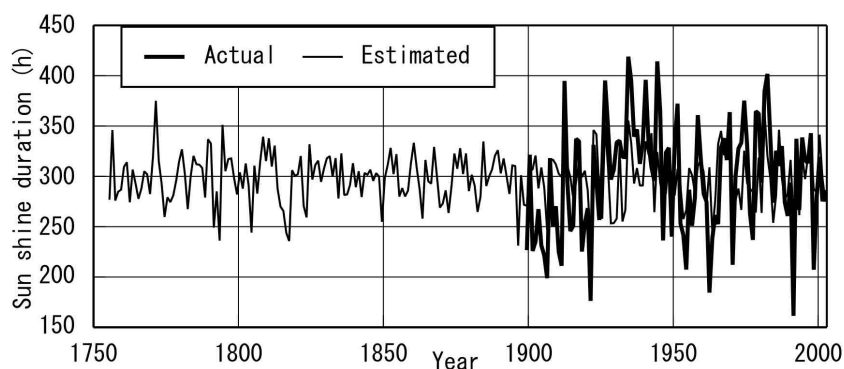


Fig. Sun shine duration of May to June reconstructed by 5 chronologies of ring width and maximum density from Yaku Sugi (*Cryptomeria japonica*).  $R^2_{adj} = 0.20$ .

図 ヤクスギ年輪幅および年輪内最大密度(計5系列)を用いた5-6月積算日照時間の復元(自由度調整済み決定係数 = 0.20)