ABSTRACTS (MASTER THESIS)

Local tracheid structure of *Cryptomeria japonica* and its potential for dendrochronology

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Introduction

Tree ring studies are important field of science, including dendrochronology, dendroclimatology and modeling the tree growth environmental response system[1]. In general, softwood often used in these studies generates tracheids accurately aligned along the radial directions and their shape and size are known to be influenced by surrounding environment. In most cases analyses have been conducted using one parameter from one tree-ring, e.g. ring-width, density, ratio of stable isotopes, and so on. However, the information within a ring, i.e. intra-annual variety of anatomical characteristics, has been less considered as a parameter of tree ring analyses[2]. Therefore, intra-annual anatomical features in *Cryptomeria japonica* from Ashiu Experimental Forest were scrutinized to extract possible relationships between climate and intra-annual ring pattern using correlation analysis.

Experimental

Ashiu experimental forests located in the center of Japan was used as a research site, and 12 cores from 6 individuals of *cryptomeria japonica* were collected. Cross-sectional optical micrographs in chronological order were created from each core. Lumen radial diameter (LRD) and cell wall thickness (CWT) were measured from all tracheids in each annual ring by image analysis. Then the local tracheid structure, that is, seasonal transition of these two parameters by small window with width equal to 10% of ring-width moving by 1% of ring-width step, was calculated. Finally, relationship between the chronologies and 31-day averaged temperature and 51-day averaged precipitation in Ashiu experimental forests was analyzed in detail.

Result and discussion

Notably, strong correlation between anatomical parameters and climates at least 6 positions was detected. Especially, temperature and precipitation in June largely affected tracheid structure from middle to latewood region. Two statistical indices, RE and CE often used in dendroclimatology revealed that local tracheid structure have a possibility to be proxies of climate reconstruction.

Furthermore, a crossdating based on the most sensitive parameter, precipitation in June (Figure 1), instead of the conventional method using ring-width was examined. Interestingly, this method reliably crossdated the core which was completely failed to crossdate by a conventional method and showed that local tracheid structure can better extract simultaneity between target cores accurately. These lines of evidences suggested that the local tracheid structure has a possibility to be a new parameter for dendrochronology.

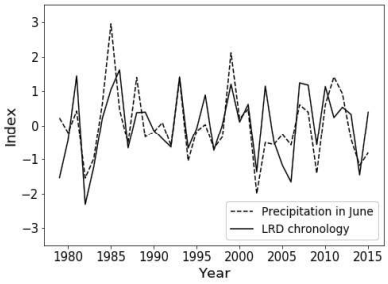

Figure 1. Time series of normalized LRD (solid) and 51-day mean precipitation sum in June (dashed).

References

[1] H.C. Fritts. Tree Rings and Climate. Academic Press, London, 1976.

[2] E. Ziaco, F. Biondi, I. Heinrich. Wood Cellular Dendroclimatology: Testing New Proxies in Great Basin Bristlecone Pine, *Frontiers in Plant Science* 7, 2016.