

Hydroclimate and precipitation d18O revealed by tree-ring cellulose d18O in semi-arid Northern China

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Oxygen isotopic ratios (d18O) of tree-ring cellulose in three different species from two different stand environments were determined in semi-arid Northern China from 1954 to 2003. They present a common inter-annual variability, despite being different tree species or being in different stand environments. The variability was highly positively correlated with temperature and negatively with precipitation and relative humidity during the growing season, although there was a significant change in temperature correlation between 1954-1978 and 1979-2003. This suggests that the past summer hydroclimate can be consistently reconstructed by tree-ring cellulose d18O from various kinds of trees growing in the semi-arid Northern China. In addition, we evaluated past changes in d18O of precipitation from the tree-ring cellulose d18O and relative humidity using the mechanical model for tree-ring cellulose d18O in Roden et al. (2000). By setting the species-dependent exchange rate of oxygen between carbohydrate and xylem water as 0.59 and 0.47 for *Larix principis-rupprechtii* and *Picea koraiensis*, we could also reconstruct the variations in precipitation d18O consistently from the different tree species, which are similar to the observed d18O of precipitation during 1985-2002. Although the reconstructed d18O of precipitation does not have any significant relation to local temperature or precipitation during 1954-2003, its long-term variation pattern is similar to that of the Asian summer Monsoon indices and d18O of stalagmites, suggesting that d18O of precipitation is not controlled by local meteorology but is influenced by large scale atmospheric circulation.

Keywords: tree-ring cellulose d18O, hydroclimate, d18O of precipitation, the Asian monsoon, Northern China