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Canopy carbon and water exchanges on forest sites with contrasting soil water availability.

In water limited environments, the predictability of the annual soil water regime varies geographically, from sites with a periodic seasonal rainfall pattern to sites with erratic and therefore much less predictable water availability. In order to investigate the contrasting adaptative pattern of trees in such environments, we compared pine stands growing on either shallow sandy soils, limited to the top 0.6 m with a high water table (W), to sites with deeper soils where roots reach a depth of 3 m below the soil surface (D). The tree sap flow, cambial growth and carbon stable isotopes composition of cellulose from thin tree rings fractions were determined over several consecutive years. In addition, water and carbon exchanges were monitored for 11 consecutive years on the W site. The carbon stable isotope composition of the thin tree ring fractions was linked to the canopy–atmosphere CO_2 flux using a simple model. The data shows that trees growing on the W site exhibit a faster growth and higher production, but experienced more severe drought than trees growing in the D site. Although the mean ring values of $\delta_{13}C$ was seasonally or annually similar among sites, the intra-ring profile was much more amplified during dry years and this seems to be more pronounced on the W site. From these data, we hypothesize that pine stands growing on the W site may be more affected by the regional climate changes expected in this area.

Key Words
Water availability, maritime pine, water use efficiency, Tree-ring, carbon isotope ratio, climate.