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A network of tree-ring chronologies was developed for the Eastern Alps considering fourteen beech stands growing at different elevations in Italy, Slovenia and Austria. Almost all chronologies were more than a hundred years long, with some stands in Carnia containing trees over 300 years old. As revealed by previous studies conducted on beech in the Italian Peninsula, maximum tree age is directly related to altitude, with the oldest stands located at the highest elevations. Tree-ring chronologies were standardized and autocorrelation removed in order to amplify the climatic signal. Hierarchical Cluster Analysis (HCA) and Principal Component Analysis (PCA), performed on the common period 1942-2001, were used to identify geographical and altitudinal patterns of tree growth as a consequence of the bioclimatic position of each stand. HCA recognized two main groups, separating hilly from montane beech forests, with the only exception of the northernmost site, showing low affinity with other stands. PCA allowed the identification of the main modes of growth variability and their relation to the spatial and altitudinal location of the sites. The first two components accounted for 51.5% of the total variance. The first component (PC1) was mainly linked to mountain and high-mountain chronologies (900 - 1500 m a.s.l.), with correlation diminishing towards lower elevation sites (200 - 800 m a.s.l.), which were better characterized by the second component (PC2). Bootstrap correlation and response function analysis between principa component scores and monthly climatic variable were used to clarify the main climatic signals underlying each component. The growth of mountain and high-mountain stands (PC1) was rather susceptible to an excess of precipitation falling before and, above all, at the beginning of the growing season (May), and to the warmth of September, a key month to lengthen cambial activity. However the strongest climatic signal is an inverse correlation with July temperature of the preceding year that can be linked to floral induction processes in beech, warm years may stimulate massive seed production (mast seeding) in the subsequent year that subtracts photosynthates to vegetative growth At lower elevations, the growth of the hilly beech forests (PC2) was limited by summer drought and by a hot May; moreover, here trees need a certain coolness during September-October of the previous year for the hardening process. It is important to note that for this component high-mountain chronologies show opposite behaviour with respect to low-mountain stands. Finally, the geographic extent of the identified signals was explored by analyzing the correlation of principal component scores with other beech chronologies built for Slovenia and Italy. The PC1 signal spread eastward to the Dinaric Alps and South-Eastern hills in Slovenia, westward to the Italian Central Alps, and southward to the Northern Apennines. This southern limit, previously identified in vegetational, climatic, and dendrochronological studies, corresponds to the biogeographic boundary between the Cold Temperate and the Mediterranean region. Scores for PC2 were also correlated with beech chronologies of the Dinaric Alps and South-Eastern hills in Slovenia, but, as a remarkable difference from PC1, had good correlation with low-elevation sites (< 1000 m a.s.l.) of Central Italy (Latium), whose growth is influenced in a similar way by late spring-summer climate. This suggests that the eastern Prealpine stands (below 700-800 m a.s.l.), thanks to their closeness to the Adriatic sea, belong to a transition belt between the Mediterranean and the Temperate Cold zones.

SE Spain with semiarid conditions (Latitude, La:38°10'N; longitude, Lo: 0°28'W; altitude, Al: 10 m a.s.l.), (2) one from the coastal part of Slovenia with submediterranean conditions (La: 45°28'N Lo: 13°42'E, Al: 50 m a.s.l, and (3) one atypical site, away from the coast, in Central Italy (La: 42° 37'N; Lo: 12° 39'E, Al: 470 m a.s.l.).

We compared the growth rates of typical dominant or co-dominant trees from three different sites using raw-non-detrended mean chronologies. Climate-growth-relationship has been investigated through the elaboration of the response functions using residual chronologies and Dendroclim2002 software.

In trees from the semiarid SE Spain interannual variability of ring-with is only significantly influenced by precipitation (previous autumn as well as current winter, spring and autumn). In contrast, in the submediterranean Slovenia only winter temperatures influenced ring-width. In an intermediate situation of Central Italy ring-width is influenced by both temperature (early spring and autumn of the current year) and precipitation (current summer and previous autumn).

These results point out the great flexibility of *P. halepensis* to be adapted to different Mediterranean conditions. We discuss implications of observed results in the context of climate change predictions for western Mediterranean areas.

Synchronization of maximum growth rate and summer solstice in North American and European conifer species: coincidence or plant adaptation?

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Timing and variability of tree-ring development were studied between 1996 and 2004 in the main European and North American conifers. Intra-annual tree-ring formation was studied in Canada and Italy by means of repeated xylem cell analyses (XCA) and automatic dendrometer measurements (ADM), assessing dynamics of cell production and stem radial growth. All the annual patterns of tree-ring development were modeled with a Gompertz function defining upper asymptote (A), x-axis placement (β) and changing rate (κ) of the curves. Timing of wood formation was assessed by evaluating the relationship between β and κ, the ratio which determines the inflection point of the model. As a strong linear relationship was found between β and κ for both XCA ($R^2=0.96$) and ADM ($R^2=0.93$), we demonstrated that the slopes of the regression correspond to the time when maximum growth rate culminates and that all inflection points converge at the same moment of the year, showing a clear development timing independently of any other variable (species, age, site, year). The convergence of maximum growth rate occurs at Julian day 164.5 for XCA and 170.8 for ADM and no significant difference was found between these values. Two fundamental aspects of annual wood formation were therefore identified. First, the culmination of growth rate during wood formation is constrained by a definite time limit, corresponding to the maximum day length, indicating a possible adaptation of the plants by regulating the annual timing of tree-ring formation on a stable climatic signal. Synchronizing the maximum growth rate with temperature culmination (end of July), as previously proposed, represents a risk for the plant as the last tracheids formed remain in differentiation until late autumn. The second important aspect concerns a wide variability observed in the timing of wood formation, from several weeks in cold climate zones to some months in temperate zones optimizing the wood production timing.

Spatial and altitudinal climatic signals identified in a beech (*Fagus sylvatica* L.) tree-ring network on the Eastern Alps

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