Trends in temperate tree growth: Stable growing season responses and changing winter climate responses

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Abstract

The role of future forests in global biogeochemical cycles will greatly depend on how different tree species respond to climate. Understanding the response of forest growth to climate change requires a sound understanding of the temporal and spatial patterns of the seasonal climatic influence on the growth of common tree species. We present a new network of 321 tree-ring width chronologies from four common tree species (*Quercus robur, Q. patraea*, *Pinus sylvestris* and *Fagus sylvatica*) in the south Baltic Sea region at the border of three bioclimatic zones (temperate continental, oceanic, southern boreal). We identified the major climate factors (temperature, precipitation, drought) affecting tree growth at monthly and seasonal scales to assess whether their effects change from 1943 to 2002. Our analysis documents that radial tree growth is generally dominated by genus-specific climate parameters where the influence of growing season climate is generally stable through time. We also documented changes in the influence of winter climate variables over the last decades for all species examined. Among much of the study region, we found a decreasing influence of winter climate on deciduous tree growth and an increasing influence of winter climate on Scots pine growth. We used the unstable winter climate growth responses to guide a descriptive application of spatial segregation analysis to identify sites significantly aggregated based on their unstable response to winter climate parameters. The findings presented here highlight the sensitivity of observed biological responses to climate change - especially in the context of seasonally non-uniform responses to climate change.