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Data-Model comparisons (DECVEG): exploring inter-annual climate variability effects on vegetation in Fennoscandia.

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Data-model comparisons exploring the response of vegetation and ecosystems to changing climate through the Holocene usually use coarse resolution (in time and space) climate data to drive the ecosystem or vegetation model. These data may be averaged over a number of years, typically 30, to give monthly or downscaled daily values of mean temperatures. However vegetation does not respond to mean temperature directly and such data may not describe the year-to year dynamics in a region with any accuracy.

Trees are long-lived organisms and as such only a relatively few years of favourable climate may allow a species to maintain a population in an area. Occasional very cold winters for example may kill a number of individuals reducing the population size which may eventually lead to changing competitive interactions among species.

Data on past inter-annual variability over long time periods can be extracted from proxy records such as tree rings and varved lake sediments. But there have been few modelling experiments comparing modelled or reconstructed inter-annual climate variability to vegetation data.

Here we explore through a data-model comparison the effects of changes in inter-annual variability on distributions and abundance of tree species in Fennoscandia. We use the dynamic ecosystem model LPJ-GUESS at the species level driven by an annual climate dataset for the last 10000 years with different formulations of inter-annual variability in part reconstructed from data.

Results indicate that vegetation development can be significantly altered depending on the formulation for inter-annual variability. Simulations with the variability extracted from the varve dataset for example best explain some of the features in the vegetation history of the boreal-nemoral ecotone of southern Finland and Sweden.

Data-model comparisons of this type are particularly important if we wish to improve understanding of the large scale movements of vegetation during the Holocene.