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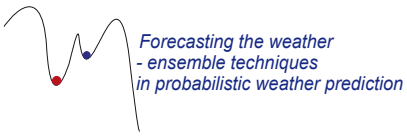

Tree-ring reconstructions and model simulations reveal millennium-long temperature coherency in the Pyrenees

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May to September temperatures in the Pyrenees for the last Millennium are reconstructed from a total of 22 maximum latewood density (MXD)) chronologies.
Different data subsets were generated: Regional chronologies including all individual measurement series, and Principal components analysis (PCA) applied to extract common variance from the subsets of individual MXD chronologies. In every case, four different tree-ring standardization methods were applied. PCA analysis for the different periods and sets of series reveals a minimum of 55% of common variance captured by the first principal component. This leading mode (PC1) was highly correlated with instrumental May-September temperature means (minimum correlation= 0.55) displaying positive loadings across the Pyrenees sites.

Calibration-verification trials were performed using the nested PCs and the regional chronologies. All tree-ring chronologies were regressed against May to September temperature means of two independent split periods. Calibration/verification tests of the linear regressed chronologies indicate a stable relationship between MXD formation and temperature variation. The various chronologies sufficiently preserve inter-annual to multi-decadal low-frequency agreement with the target climate record. Uncertainties on the reconstruction related to the differences on the precursor chronologies and the calibration model used for reconstruction were assessed.

The resulting temperature evidence was compared with simulations of last millennium climate performed with global and regional climate models. The global model is atmosphere-ocean coupled model (ECHO-G) and the regional model is a modified version of the MM5 used to produce high spatial resolution simulations of the last millennium over Iberian Peninsula driven by boundary conditions provided by ECHO-G. All simulations were produced incorporating changes in external forcing factors (solar irradiance, volcanisms and trace greenhouse gases) estimated from proxy data.