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Unforced variability in summer storm track position over the past millennium

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Gridded past millennium climate reconstructions, encompassing the European continent (e.g. Luterbacher et al 2004), based on proxy records, have previously been generated assuming that spatial temperature covariance across the region behaves in the past in the same way as it does in the observational period. This strategy bears the risk of artificially identifying the same patterns of variability as presently observed and overlooking periodically occurring modes of internal climate variability, that are not uniformly spatio-temporally expressed. Here, we construct regional proxy composites for Europe which are not constrained by the modes of variability expressed in the 20th century, and should thus broadly represent coherent regional summer temperatures back through time, independent from present modes of variability. The proxy data set analysed was provided by the efforts of the EU 6th Framework Millennium project. Proxy data are dominated by tree ring width, density and annual height increment. Four composites are used describing summer temperatures in the Arctic, Central, Pyrenean and Alpine zones of Europe. The proxy data sets cover the period AD 1260-1996. We jointly analyse an ensemble of simulations with global climate models participating in the Climate Model Intercomparison Project (CMIP5) included in the 5th Assessment report of the Intergovernmental Panel on Climate Change (IPCC) covering the period AD 850-2005, with the above aims in mind. The climate models were driven by estimations of the main external forcings. The implementations of these forcings may vary among simulations, depending on the different estimates used and on the structure of the models themselves. We analyse three simulations (CCSM4, IPSL, MPI-ESM) that, at the time of writing, provide daily data over the period AD 850-2005 obtained with the very same model version through the whole period. The analysis of both proxy and model data allowed us to more precisely identify the behaviour of the internal climate mode identified.