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Improving age models for abrupt climate changes during the last glacial by pattern recognition

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Quaternary records provide an opportunity to examine how regional climates and vegetation reflect global climate changes comparable in magnitude and velocity to those expected during the 21st century. The Dansgaard-Oeschger (D-O) cycles of the last glacial period provide the best documented examples of such rapid climate warmings (Greenland interstadials, GIs). However, the age models of pollen records that document regional responses to D-O events are, in general, poorly constrained beyond the radiocarbon timescale. Here we use a pattern-recognition approach, based on matching oscillations in palaeoclimate records to a template of D-O events seen in the Greenland record, to provide better constrained age models. We create a series of templates of Greenland Interstadials (GIs) and compare these to a normalised and detrended time series from a target record using a sliding window and measuring goodness-of-fit using Euclidian distance. We show that this approach can identify D-O events in well-dated records, including reproducing the Greenland record itself. We then apply this approach to the less well-constrained pollen records from the last glacial period from southern Europe. The re-aligned age models permit a more robust comparison of the reconstructed vegetation and climate changes through time and across sites, allowing for regional differences in the response to individual GIs to be identified.