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Testing the assumption of synchronous Dansgaard Oeschger events in ice cores and speleothems: Linking GICC05 to the U/Th timescale via cosmogenic radionuclide records

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A key assumption underlying various climate proxy records and analyses is that Dansgaard-Oeschger (DO) events occur synchronously in the records where they are observed. From a thermodynamical point of view this is likely, however, this assumption is rarely tested even though there are indications that even rapid climate change may be time-transgressive (e.g., Lane et al., 2013; Fleitmann et al., 2009; Li et al., 2017). One of the main challenges in assessing this hypothesis lies in the accuracy and precision of the underlying timescales. Variations in the production rates of 14C and 10Be (driven by changes in the solar and geomagnetic field, and thus truly external) provide a powerful tool to link the timescales of different climate archives (Adolphi and Muscheler, 2016; Muscheler et al., 2014). In this study, we employ 10Be records from ice cores and 14C records from U/Th-dated archives to link Greenland ice cores to the U/Th timescale. We show that while GICC05 is correct within uncertainties, its relation to the U/Th timescale is drifting over time. Using these cosmogenic matchpoints between the timescales, we can improve the precision of the ice core timescale by a factor of 2-3 back to 50kaBP. This allows us to rigorously assess the timing of DO-type variability seen in ice cores and speleothems and discuss the implications for the dynamics of past rapid climate change.

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