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A detailed analysis of the recurrence time for the rapid Dansgaard-Oeschger climate events

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Understanding the rapid DO climate shifts is a challenge. Whether they are internally noise driven or caused by external factors is still unknown. Climate models are presently not capable of simulating DO events and several different mechanisms have been proposed, ranging from non-linear oscillations involving switches between sea ice and glacial ice, stochastic or coherent resonances as response to solar forcing, externally or internally driven abrupt changes in the Atlantic meridional overturning circulation or ice sheet instabilities.

Time series analysis of the paleoclimatic records should be a guideline for excluding and validating possible mechanisms. With the new unprecedented accuracy in dating of the NGRIP ice core record, the waiting times between events are analyzed. A simple stochastic model reproducing the waiting time distribution and the characteristic saw-tooth shapes of the DO events is capable of generating the observed record. This points to the events being internally noise induced and the speed at which interstadial states are destabilized being a stochastic variable, determined at the transitions, perhaps related to the state of the ice sheet.