



Limitations of statistical standard methods in analysing Dansgaard-Oeschger events

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North Atlantic climate during glacial times was characterised by large-amplitude switchings, the Dansgaard-Oeschger (DO) events, with a reported tendency to recur preferably in multiples of about 1470 years during Marine Isotope Stages 2 and 3. Among other hypotheses, several theoretical attempts were made in order to link the timing of DO events to noise and/or quasi-periodic (e.g. solar) forcing. To test the proposed solar link, various studies have already been performed. While some tests were reported to provide support for this link, other results were regarded as inconsistent with the suggested solar role in triggering DO events.

Here we address the skill of statistical standard methods (such as linear correlational, spectral and phase-relationship analyses) to test the suggested solar role in triggering DO events. Using a conceptual model for the nonlinear dynamics of DO events (which was derived from the dynamics of the events in the coupled ocean-atmosphere model CLIMBER-2) we discuss under which conditions millennial-scale DO events can be triggered by century-scale solar forcing. We demonstrate that - as a consequence of the threshold crossing character of DO events - most statistical standard methods do not seem to be adequate to test the proposed solar role in triggering DO events. More appropriate statistical methods are thus required, which explicitly account for the non-linearity that is inherent in the dynamics of DO events.