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## Paleoclimatic tipping points and abrupt transitions: An application of advanced time series analysis methods

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Paleoclimate proxy records contain abrupt transitions that may represent former instances of the climate system crossing a tipping point (TP). Properly identifying these TPs in the Earth's past helps determine critical thresholds in present-day climate and better understand the climate system's underlying bifurcation mechanisms.

Information contained in paleoclimate proxy records is often ambiguous because of the complexity of the system, which includes both deterministic and stochastic processes. Furthermore, paleoclimate time series differ in their time spans and periodicities, and often have high levels of noise and a nonuniform resolution. These combined sources of uncertainty highlight the need for using advanced statistical methods for robustly identifying and comparing TPs.

A recently developed method that uses an augmented Kolmogorov-Smirnov test has been shown to be highly effective for transition detection in different types of records. Here, we apply this method to a set of high-quality paleoproxy records exhibiting centennial-to millennial-scale variability that have been compiled in the PaleoJump database. We thereby detect previously unrecognized transitions in these records and identify potential TPs. Furthermore, we investigate regime changes with recurrence analysis and spectral analysis.

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