



## **Tipping points toolbox: novel techniques of time series analysis for studying transitions and bifurcations in climatic records**

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We develop and apply a set of novel techniques of time series analysis to studying transitions and bifurcations in climatic records. The techniques are degenerate fingerprinting (indicators based on lag-1 autocorrelation and detrended fluctuation analysis) and potential analysis (derivation of underlying system potential and its dynamics). The techniques allow us to distinguish transitions and bifurcations in the climate system and to detect approaching critical behaviour (early warning). We test the toolbox on artificial data with known properties and then apply to case studies of geophysical data.

[1] Lenton et al, PNAS 2008

[2] Livina & Lenton, GRL 2007

[3] Livina et al, Climate of the Past 2010

[4] Livina et al, Climate Dynamics, in press.

[5] Lenton et al, Phil Trans Royal Soc A, submitted