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Estimating nonlinear stability from time series data

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Basin stability (BS) is a measure of nonlinear stability in multistable dynamical systems. BS has previously been estimated using Monte-Carlo simulations, which requires the explicit knowledge of a dynamical model. We discuss the requirements for estimating BS from time series data in the presence of strong perturbations, and illustrate our approach for two simple models of climate tipping elements: the Amazon rain forest and the thermohaline ocean circulation. We discuss the applicability of our method to observational data as constrained by the relevant time scales of total observation time, typical return time of perturbations and internal convergence time scale of the system of interest and other factors.