Systematic assessment of climate tipping points

Sina Loriani¹, Boris Sakschewski¹, Jonathan Donges¹,², and Ricarda Winkelmann¹,³

¹Potsdam Institute for Climate Impact Research, Potsdam, Germany
²Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden
³Institute for Physics and Astronomy, University of Potsdam, Potsdam, Germany

Tipping elements constitute one high-risk aspect of anthropogenic climate change - after their critical thresholds are passed, self-amplifying feedbacks can drive parts of the Earth system into a different state, potentially abruptly and/or irreversibly. A variety of models of different complexity shows these dynamics in many systems, ranging from vegetation over ocean circulations to ice sheets. This growing body of evidence supports our understanding of potential climate tipping points, their interactions and impacts.

However, a systematic assessment of Earth system tipping points and their uncertainties in a dedicated model intercomparison project is of yet missing. Here we illustrate the steps towards automatically detecting abrupt shifts and tipping points in model simulations, as well as a standardised evaluation scheme for the Tipping Point Model Intercomparison Project (TIPMIP). To this end, the model outputs of taiylored numerical experiments are screened for potential tipping dynamics and spatially clustered in a bottom-up approach. The methodology is guided by the anticipated setup of the intercomparison project, and in turn contributes to the design of the TIPMIP protocol.