



## **The possibility of a tipping point in the Arctic sea ice cover, and associated early-warning signals**

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As the Arctic sea ice has become one of the primer indicators of global climate change, with a seemingly accelerated loss in both ice extent and volume the latest decades, the existence of a tipping point related to the Arctic sea ice cover has been widely debated.

Several observed and potential abrupt transitions in the climate system may be interpreted as bifurcations in randomly driven dynamical systems. This means that a system approaching a bifurcation point shifts from one stable state to another, and we say that the system is subject to a critical transition. As the equilibrium states become unstable in the vicinity of a bifurcation point the characteristic relaxation times increases, and the system is said to experience a “critical slowing down”. This makes it plausible to observe so called early-warning signals (EWS) when approaching a critical transition.

In the Arctic non-linear mechanisms like the temperature response of the ice-albedo feedback can potentially cause a sudden shift to an ice-free Arctic Ocean. Using bifurcation theory and potential analyses we examine time series of observational data of the Arctic sea ice, investigating the possibility of multiple states in the behavior of the ice cover. We further debate whether a shift between states is irreversible, and whether it can be precluded by early-warning signals.