

## **THE LINK BETWEEN EXTREME EVENTS AND TIPPING POINTS**

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This talk originates from a review paper on the link between extreme events and tipping points focusing on mechanisms of tipping. Weather and climate extreme events can play a role in influencing tipping elements and triggering tipping points in the Earth System. Example of a potential critical global tipping point, induced by climate extremes in an increasingly warmer climate, is an Amazon rainforest dieback that could be driven by regional increases in droughts and exacerbated by hot temperatures and fires, in addition to deforestation. A tipping element associated with the boreal forest might also be vulnerable to heat, drought and fire. However, substantial scientific uncertainty remains on mechanistic links between extreme events and tipping points. Extreme heat events may furthermore play an important role in ice sheet, glacier and permafrost stability. Regional severe extreme events could also lead to tipping in ecosystems, as well as in human systems, in response to climate drivers. Earth observations are of high relevance to evaluate and constrain those links between extreme events and tipping elements, by determining conditions leading to delayed recovery with a potential for tipping in the atmosphere, on land, in vegetation, and in the ocean. In the subsurface ocean, there is a lack of consistent, synoptic and high frequency observations of changes in both ocean physics and biogeochemistry. This review article shows the importance of considering the interface between extreme events and tipping points, two topics usually addressed in isolation, and the need for continued monitoring to observe early warning signs and to evaluate Earth system response to extreme events as well as improving model skill in simulating extremes, compound extremes and tipping elements.