PCF Dialogue 1

Danger in the tail: The policy implications of underestimating the risks of permafrost carbon feedback

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CASCADE INSTITUTE

TWO CONCEPTS:

Fat-tailed probability distributions

Climate hysteresis

Fat-tailed probability distributions

“Under business-as-usual climate forcing scenarios, much of the upper permafrost is projected to thaw within a time scale of about a century. *Exactly how this will proceed is uncertain.* The rate of carbon degradation increases nonlinearly with temperatures above the freezing point of water. Furthermore, the spatial pattern of this degradation is spatially heterogeneous owing to small-scale geomorphic processes such as thermokarsting and slumping from ice-wedge melting.”

National Academy of Sciences, 2013,
Abrupt Impacts of Climate Change: Anticipating Surprises

"Arctic carbon stores are poised to play a significant amplifying role in the century timescale buildup of CO2 and methane in the atmosphere, but are unlikely to do so abruptly, on a time scale of one or a few decades. *This conclusion is based on immature science, however, and a truly sparse monitoring capability*."

National Academy of Sciences, 2013,
Abrupt Impacts of Climate Change: Anticipating Surprises

Symposium:

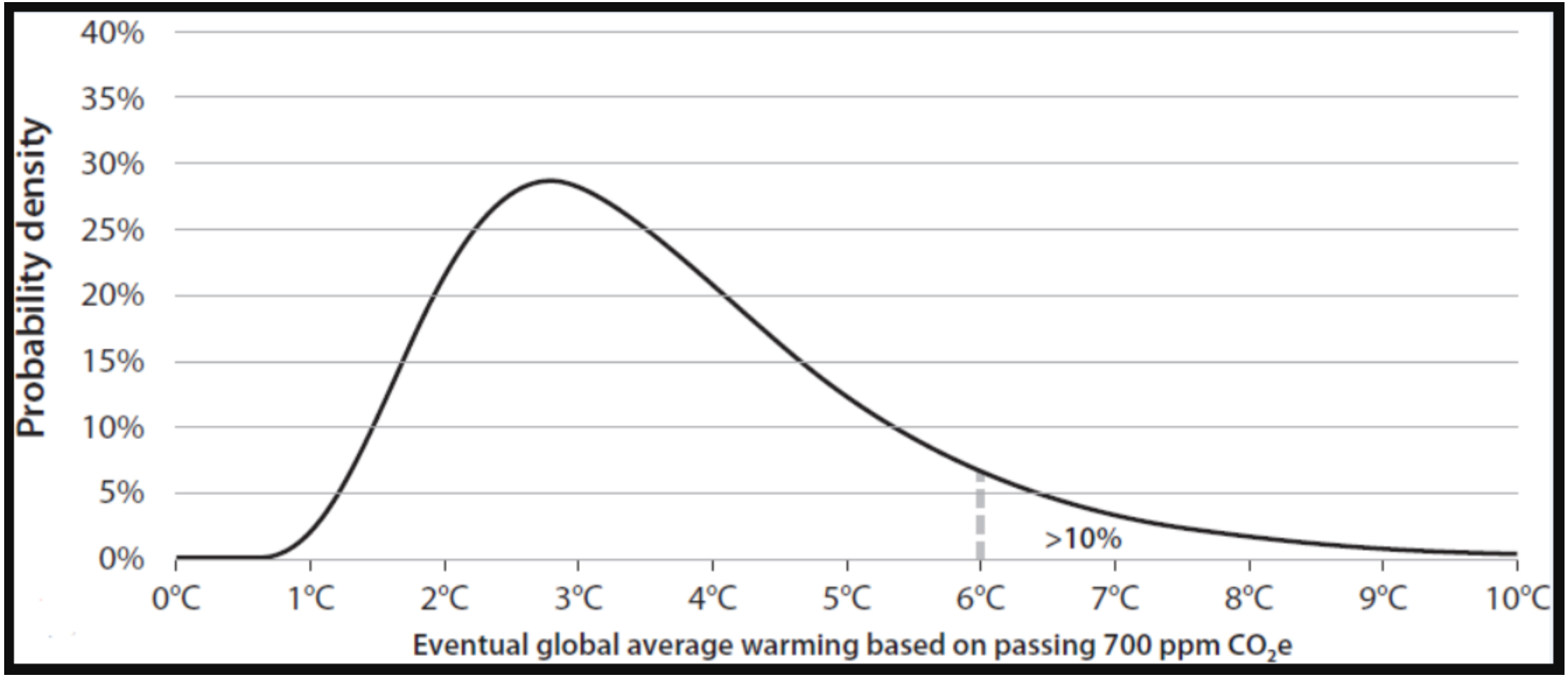
Fat Tails and the Economics of Climate Change

Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change

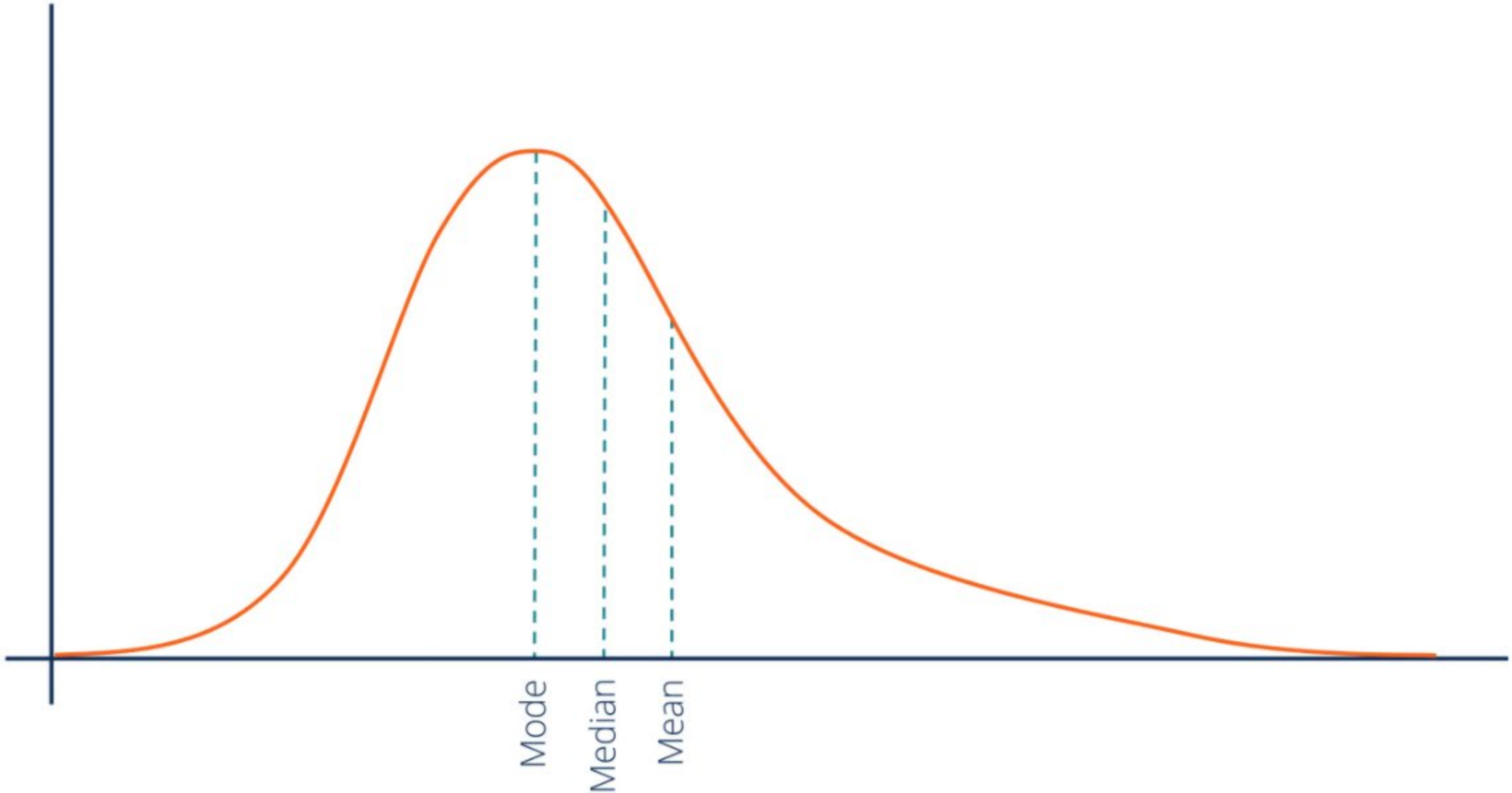
Martin L. Weitzman*

“I believe that the most striking feature of the economics of climate change is that its extreme downside is nonnegligible. Deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages. This is a recipe for producing what are called ‘‘fat tails’’ in the extremes of critical probability distributions. . . . It is difficult to judge how fat the tail of catastrophic climate change might be because it represents events that are very far outside the realm of ordinary experience.”

Martin Weitzman, 2011, “Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change,” *Review of Environmental Economics and Policy.*



Wagner and Weitzman, *Climate Shock*, 2017


Mode
Median
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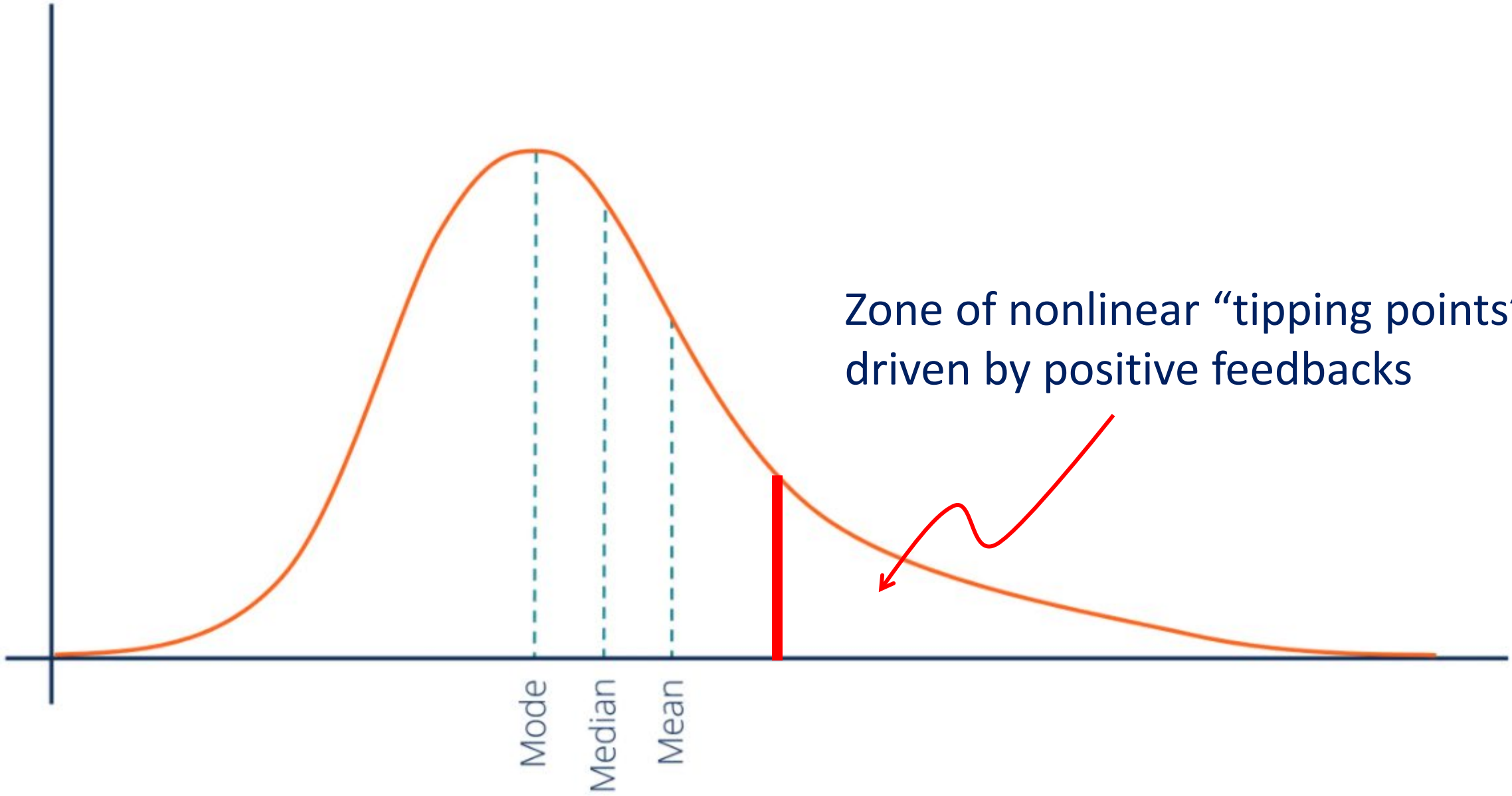

Zone of nonlinear “tipping points”
driven by positive feedbacks
Mode
Median
Mean

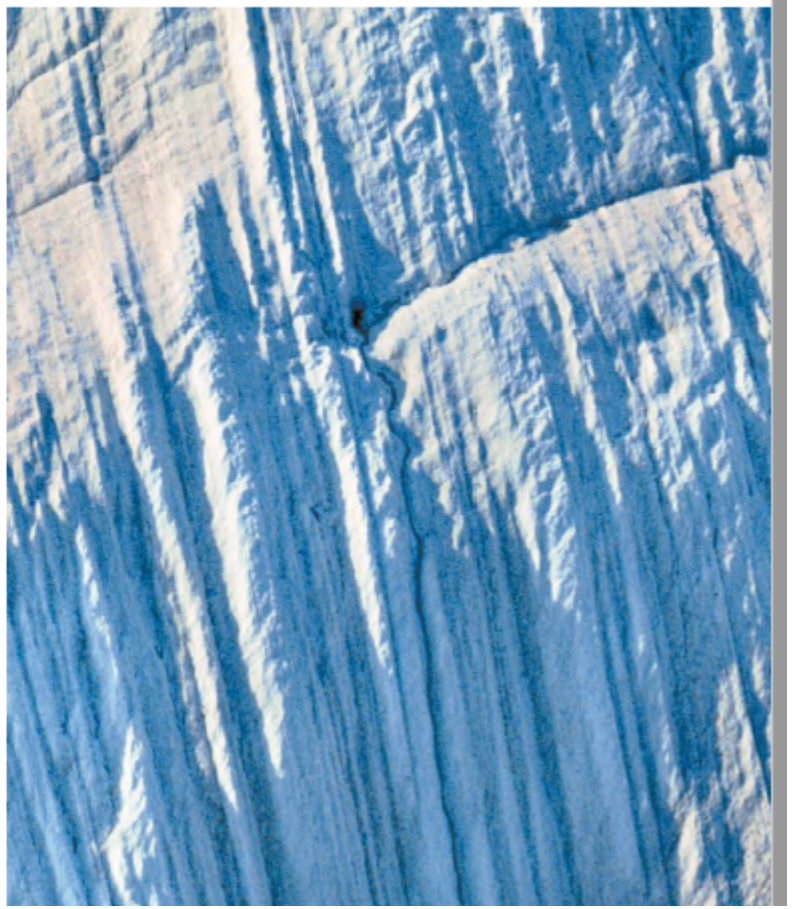
Comment

Climate tipping points — too risky to bet against

Timothy M. Lenton, Johan Rockström, Owen Gaffney, Stefan Rahmstorf, Katherine Richardson, Will Steffen & Hans Joachim Schellnhuber

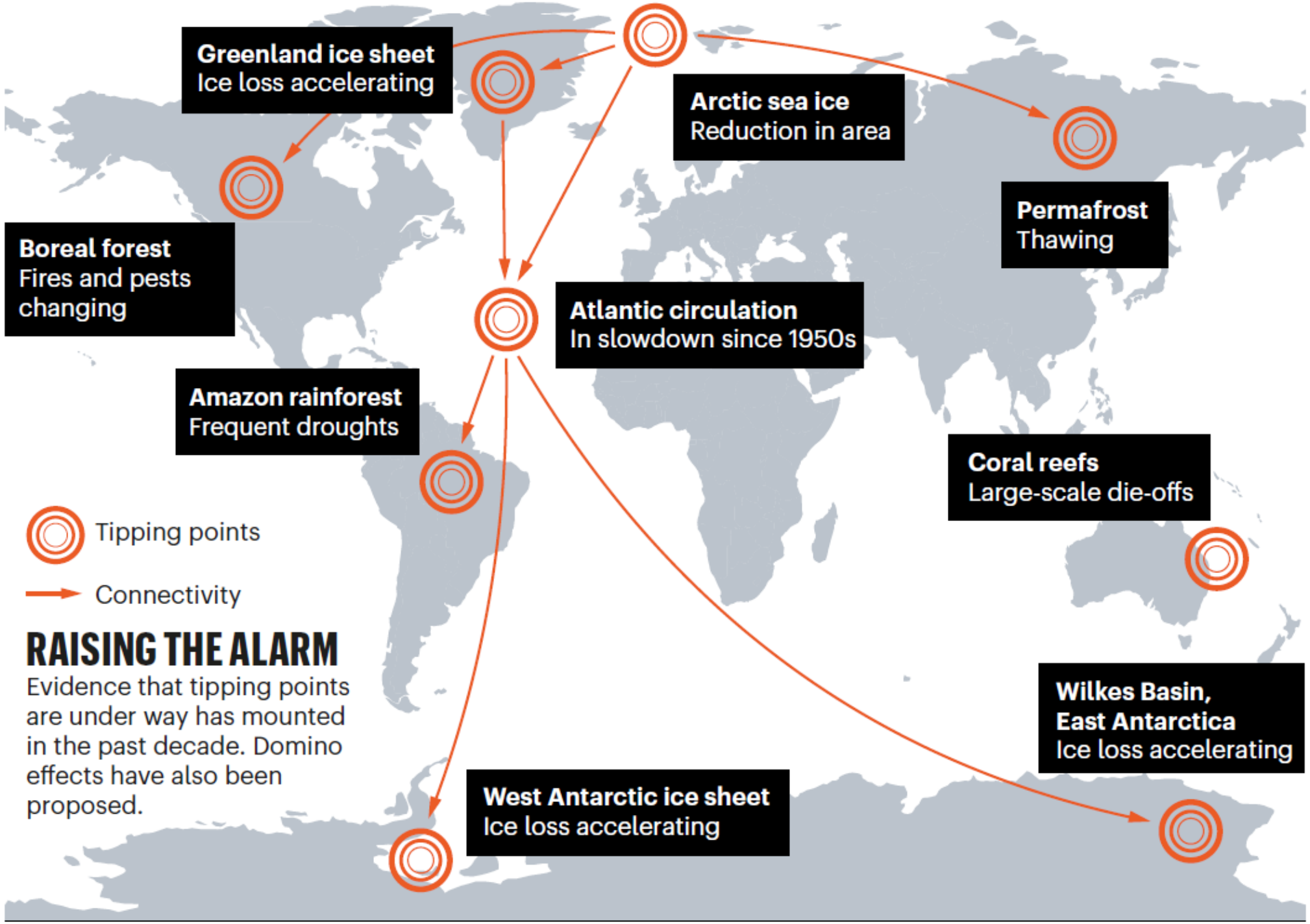
The growing threat of abrupt and irreversible climate changes must compel political and economic action on emissions.

assuming that climate tipping points are of very low probability (even if they would be catastrophic), have suggested that 3 °C warming is optimal from a cost–benefit perspective. However, if tipping points are looking more likely, then the 'optimal policy' recommendation of simple cost–benefit climate-economy models[4] aligns with those of the recent IPCC report[2]. In other words, warming must be limited to 1.5 °C. This requires an emergency



Nature, 28 November 2019

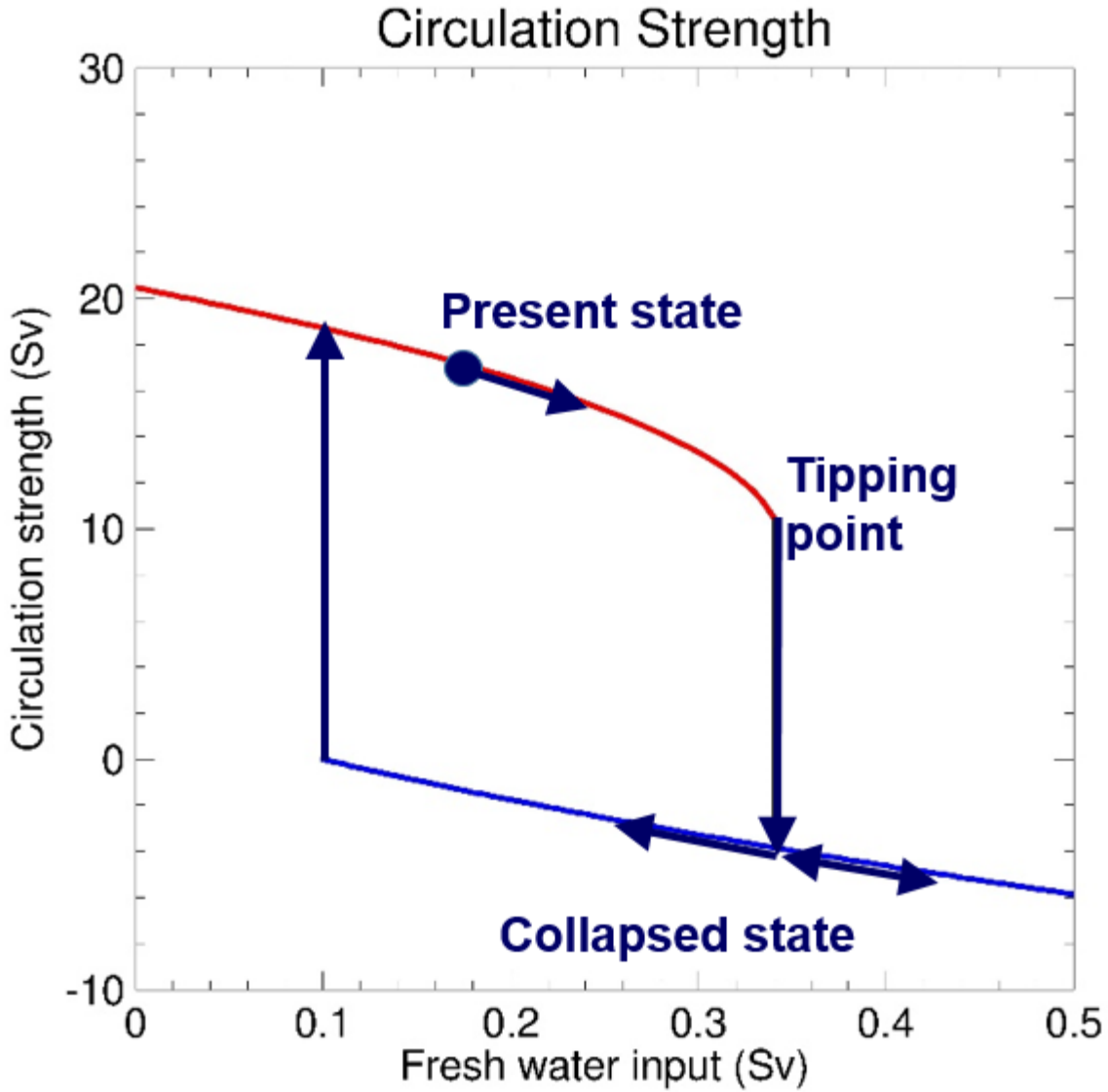
“The clearest emergency would be if we were approaching a global cascade of tipping points that led to a new, less habitable ‘hothouse’ climate state. . . . We argue that cascading effects might be common [and] examples are starting to be observed.”



SOURCE: T. M. LENTON *ET AL.*

“The evidence from tipping points alone suggests that we are in a state of planetary emergency.”

Climate hysteresis



“We need to reach a social tipping point, before we reach a planetary one.”

Will Steffen