



Achieving net zero greenhouse gas emissions critical to limit climate tipping risks

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Under current emission trajectories, at least temporarily overshooting the Paris global warming limit of 1.5 °C above pre-industrial levels is a distinct possibility. Permanently exceeding this limit would substantially increase the risks of triggering several climate tipping elements with associated high-end impacts on human societies and the Earth system. It is essential to assess this risk under emission pathways that temporarily overshoot 1.5 °C. Here, we investigate the tipping risks associated with a number of policy-relevant future emission scenarios, using a stylised Earth system model that comprises four interconnected core tipping elements. Assessing tipping risks in the year 2300, we find a non-linear increase for overshoots that exceed 1.8 °C peak temperature or persist above 1.5 °C beyond the end of the 21st century. Scenarios following current policies or pledges lead to high tipping risk of 30% (median) and more, with uncertainty from climate sensitivity and carbon-cycle feedbacks translating to large uncertainties in tipping risk (45% and more) for these scenarios. Further, we show that on multi-century timescales achieving and maintaining at least net-zero greenhouse gas emissions is paramount to minimise tipping risks. Our results underscore that stringent emission reductions in the current decade in line with the Paris Agreement 1.5 °C limit are critical for planetary stability.