Economic impacts of tipping points in the climate system

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Climate scientists have long emphasized the importance of climate tipping points like thawing permafrost, ice sheet disintegration, and changes in atmospheric circulation. Yet, save for a few fragmented studies, climate economics has either ignored them, or represented them in highly stylised ways. We provide unified estimates of the economic impacts of all eight climate tipping points covered in the economic literature so far, using a meta-analytic integrated assessment model (IAM) with a modular structure. The model includes national-level climate damages from rising temperatures and sea levels for 180 countries, calibrated on detailed econometric evidence and simulation

modelling. Collectively, climate tipping points increase the social cost of carbon (SCC) by $\sim$25% in our main specification. The distribution is positively skewed, however. We estimate a $\sim$10% chance of climate tipping points more than doubling the SCC. Accordingly, climate tipping points increase global economic risk. A spatial analysis shows that they increase economic losses almost everywhere. The tipping points with the largest effects are dissociation of ocean methane hydrates and thawing permafrost. Most of our numbers are probable underestimates, given some tipping points, tipping point interactions and impact channels have not been covered in the literature so far, but our method of structural meta-analysis means that future modelling of climate tipping points can be integrated with relative ease, and we present a reduced-form tipping points damage function that could be incorporated in other IAMs.