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## Climate-economy feedbacks, temperature variability, and the social cost of carbon

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A key statistic describing climate change impacts is the “social cost of carbon” (SCC), the total market and non-market costs to society incurred by releasing a ton of CO<sub>2</sub>. Estimates of the SCC have risen in recent years, with improved understanding of the risk of climate change to various sectors, including agriculture [1], mortality [2], and economic growth [3].

The total risks of climate impacts also depend on the representation of human-climate feedbacks such as the effect of climate impacts on GDP growth and extremes (rather than a focus only on means), but this relationship has not been extensively studied [4-7]. In this paper, we update the widely used PAGE IAM to investigate how SCC distributions change with the inclusion of climate-economy feedbacks and temperature variability. The PAGE model has recently been improved with representations of permafrost thawing and surface albedo feedback, CMIP6 scenarios, and empirical market damage estimates [8]. We study how changes from PAGE09 to PAGE-ICE affected the SCC, increasing it up to 75%, with a SCC distribution with a mean around \$300 for the central SSP2-4.5 scenario. Then we model the effects of different levels of the persistence of damages, for which the persistence parameter is shown to have enormous effects. Adding stochastic interannual regional temperature variations based on an analysis of observational temperature data [9] can increase the hazard rate of economic catastrophes changes the form of the distribution of SCC values. Both the effects of temperature variability and climate-economy feedbacks are region-dependent. Our results highlight the importance of feedbacks and extremes for the understanding of the expected value, distribution, and heterogeneity of climate impacts.

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