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## Improving the decision-making in DICE: self-adaptive climate policies to handle explicit uncertainty and adaptation modelling

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DICE (Dynamic Integrated Climate Economy) and other cost-benefit integrated assessment models are used to study the economically optimal climate policy or to evaluate economic performance of alternative policies, such as 2°C compliant emission trajectories.

Recently, DICE has been updated to provide economically optimal climate policies keeping global warming in line with the Paris Agreement. Yet, explicit uncertainty and adaptation modelling are still overlooked. Introducing these components requires a transition from the traditional perfect-foresight static decision-making framework to a dynamic one, able to change strategy in order to react to the realization of uncertainties.

In this work, starting from the updates proposed by Hansel et al. (2020), we present an updated DICE model that: i) explicitly represents adaptation in the form of temporary and long-term adaptation investment; ii) explicitly describes stochastic, parametric and structural uncertainty over the physical and socio-economic components of the model including adaptation efficiency and climate damages specification; iii) leverages self-adaptive control policies to implement a more realistic decision-making scheme that allows to adjust climate policy after that new information arises.

Results show that the self-adaptive policies allow for a reduction in the discrepancy between economically optimal climate policy and the 2°C temperature target set with the Paris Agreement, which resurfaces when introducing adaptation, also in presence of uncertainty. When using self-adaptive policies, average adaptation costs remain low and, thanks to the ability to modulate adaptation choices depending on the scenario eventually unfolding, also climate damages are maintained at a low level. As a result, more economic resources are made available for mitigation in the short-term resulting in a reduced temperature increase in 2100 for a same level of welfare.