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Climate targets to limit global sea-level rise

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Until December of 2016, 194 parties have signed the Paris Agreement on dealing with greenhouse gases emission mitigation to limit global-mean surface temperature well below 2.0˚C above pre-industrial level, and to pursue efforts to limit the temperature increase to 1.5˚C above pre-industrial level by 2100. However, when halting a surface warming below 2.0˚C or to 1.5˚C by 2100, a continuous rise of global sea level rise will remain several centuries or even for millennia and beyond (Schaeffer et al., 2012; Meehl et al., 2012; Clark et al., 2016). One possible interpretation of a 'successful climate policy' for the next few decades could be that it should avoid 'dangerous impact' on global climate, ecosystems and human societies not only within this century, but also for the next centuries and beyond. In this study, we explore a possible mitigation scenario to limit global sea-level rise by 2200.

We employ a simple three-layer ocean model, and an empirical sea-level rise model due to Greenland ice-sheet melting as constructed by a coupled climate and ice-sheet model (Fettweis et al., 2013), then further employed within the integrated climate-energy-economy model, MIND (Model of Investment and Technological Development, Edenhofer et al., 2005; Neubersch et al., 2014). Using this upgraded integrated assessment model MIND, we explore mitigation scenarios based on cost-effectiveness analyses of temperature versus sea level targets to limit short-term and long-term global sea-level rise.

A first series of results indicates significant differences in the timing of mitigation effort and subsequent mitigation cost among those different targets. The mitigation cost of global sea-level targets, where we limit global sea-level rise at the same level of 2.0˚C or 1.5˚C targets, are much lower than the cost of respective temperature targets. We also found that sea-level targets offer us more time for a relatively smooth energy system reformation. However, we cannot halt global sea-level rise by 2200, because the missing of CO_2 removal efforts in the MIND. It requires further investigation on developing mitigation scenarios to halt global sea-level rise with involving CO_2 removal efforts.

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