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Economic evaluation of adaptation pathways and their robustness to sea level rise in Los Angeles County

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Climate change is expected to accelerate sea level rise around the world. As a result, many coastal communities will become more vulnerable to flooding. Long term adaptation planning for the effects of increased future flood risk is complex due to uncertainty in both sea level rise scenarios and socio-economic developments. Current methods to evaluate the economic efficiency of adaptation strategies, such as a standard cost-benefit analysis (CBA), are often not flexible enough to cope with future uncertainties, and generate large quantities of data to analyze. Therefore, this study introduces a novel, comprehensive CBA framework to evaluate flexible adaptation pathways while addressing future uncertainty. The framework allows for a delay in adaptation, and to address the effects of either 'over- or under-adaptation'.

The new framework is applied to a case study of Los Angeles County. First the current- and future flood risk is estimated using a detailed and spatial explicit flood risk model, coupled to a hydrodynamic inundation model (CoSMoS). Using the risk simulations for different future scenarios, a conventional CBA is firstly applied to evaluate the costs and benefits of different adaptation strategies. Next, the new framework is used to evaluate adaptation delay, and transitions between adaptation strategies assuming different sea level rise projections.

Results show that the delay of some investments can be more economically efficient than investing right away, especially due to the relatively higher risk reductions in the future. The transition from one adaptation strategy to another is shown to be economically efficient in some cases, but because of loss of capital of the first investments, often less efficient than delay of a single strategy. Most strategies show robustness when anticipating a wrong sea level rise projection, up until a tipping point - which is often a large investment. The framework offers policy makers the possibility to evaluate a broader range of economically efficient adaptation options as compared to conventional CBA.