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The role of extreme sea levels in coastal flood impact and adaptation studies

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Coastal impact and adaptation assessments require detailed knowledge on extreme sea levels (ESL), because increasing damage due to extreme events is one of the major consequences of sea-level rise (SLR) and climate change. Over the last few decades, substantial research efforts have been directed towards improved understanding of past and future SLR; different scenarios were developed with process-based or semi-empirical models and used for coastal impact studies at various temporal and spatial scales to guide coastal management and adaptation efforts. Uncertainties in future SLR are typically accounted for by analyzing the impacts associated with a range of scenarios and model ensembles.

On the other hand, there is still a limited understanding of present-day ESL which is largely ignored in most impact and adaptation analyses. The two key uncertainties stem from: (1) numerical models that are used to generate long time series of storm surge water levels, and (2) statistical models used to determine present-day ESL exceedance probabilities. There is no universally accepted approach to obtain such values for broad-scale flood risk assessments and while substantial research has explored SLR uncertainties, we quantify, for the first time globally, key uncertainties in ESL estimates. We also quantify how present-day and future flood risk estimates for large coastal port cities are modulated by using different ESL data sets.