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Changing compound flood probability at the global scale under anthropogenic climate change

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When a large amount of precipitation and a storm surge occur simultaneously over a low-lying coastal area, they can cause a flooding that can be worse than when they occur in isolation. This type of flooding is known as Compound Flooding (CF). Both storm surges and heavy precipitation, as well as their interplay, is likely to change in response to anthropogenic global warming. Despite the CF relevance, the assessment of CF is mostly limited to individual locations and a global study of future CF considering changes in extreme sea level and precipitation is missing. Here, based on model simulations, we estimate the probability of potential CF at the global scale both for present and future climate according to the business-as-usual scenario. In particular, we analyse CF through the probability of co-occurrence of extreme sea level and precipitation. Future model projections show a robust increase in the CF probability in the northern part of the northern hemisphere. This increase is mostly driven by an increase of precipitation extremes. Also changes in the dependence between precipitation and sea level can drive significant changes in the CF probability, however, models disagree on the sign of this dependence-driven CF change. Societies are aware that sea level rise (SLR) will be the primary threat to coastal areas at the end of the 21st century and that, although challenging, they will need to adapt to this hazard. Here, we highlight that in several regions worldwide, CF should be considered as a potential additional hazard aggravating the risk caused by SLR in the future. We show the regions where the CF hazard is likely to increase in the future, providing users interested in coastal flooding adaptation with a basis for follow-up studies of the local CF risk.