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Semi-probabilistic flood risk analysis including climate change uncertainties

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Flood risk analysis is of the utmost importance for policy makers and water managers as an input for the design and management of water bodies. In order to assess the frequency and severity of potential extreme floods, both data analysis and modelling, or even a combined approach can be employed. However, the spatial and temporal context of flood events is often complex, in particular when the extreme water levels can be caused by a combination of extreme upstream discharges, extreme downstream water levels and/or extreme wind events, and given the additional impact of climate change. This complexity hampers a straightforward analysis and extrapolation of rare flood events. We therefore present a semi-probabilistic flood risk analysis, that combines an ensemble approach, using different hydrological models and various climate scenarios, with a methodology that describes the extreme domain of the different flood drivers by a nested Copula. The latter Copula is based on the individual univariate extreme value distributions of each of the drivers. Synthetic design conditions for different return periods can be generated by a stratification of the obtained probability domain for extreme events. An application for the catchment of the River Scheldt in Belgium will be used to illustrate the presented approach for flood risk analysis, including an ensemble of 3 hydrological models, multiple climate scenarios for different time horizons and different projections of sea level rise.