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Climate Change Impacts on Flood risk in Urban Areas due to Combined Effects of Extreme Precipitation and Sea Surges

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Climate change will impact the hydrological cycle greatly and lead to increases in flood hazards due to both pluvial and fluvial floods as well as sea surges in many regions. The impacts of the individual effects are analysed for a catchment in Greater Copenhagen. Based on both the present and anticipated future hazards the two most important hazards are found to be flash floods induced by precipitation and sea surges, respectively.

The present and future extreme properties of these two variables are modelled by means of partial duration series with parameters that contains annual variations. By means of Monte Carlo simulation the combined present and future hazards are modelled by means of copula functions.

The simulation results show that the observed correlation between the two variables can be assumed to be due to the underlying annual variation of the extremes of precipitation and sea surges. Presently the most important hazard is due to extreme precipitation. However, due to climate change impacts the future most important hazard is due to sea surges. The increase in probability of floods is substantial over a 70 year horizon and actions must be taken to decrease either the hazards or the impacts.