Risk to Assets and Communities from Coastal Flooding:
Quantifying the effect of sea level rise and flood adaptation strategies

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Abstract: Coastal communities are increasingly vulnerable to flooding due to rising sea levels. Increasing sea levels pose planning and management challenges to stakeholders in coastal regions. Understanding the effects of sea level rise on frequency and consequence of coastal flooding and subsequent social, economic, and ecological impacts is of utmost importance for policymakers to implement effective interventions and adaptation strategies. Effective strategies may consider impacts from both cumulative losses from minor flooding and acute losses from major floods and extreme events. In this study we develop a decision framework for assessing coastal flood risks from minor, moderate, and major floods to evaluate the level of implementation of adaptation and mitigation strategies requisite to mitigating the coastal flooding risks under uncertainty. A key contribution of the approach is the use of Mean Sea level (MSL) as the covariate to characterize nonstationary conditions instead of time, which is commonly used as the covariate. The frequency of extreme values of maximum daily sea water level data were assessed based on the peak-over-threshold (POT) and Generalized Pareto Distribution (GPD). Quantile regression was used to incorporate variable GPD thresholds in the analysis. The methodology and framework were employed to assess coastal flood risks to assets and communities in 10 populated coastal cities in the United States. Specifically, the social environmental justice implications of coastal flooding are discussed.

Keywords: Non-stationary; Flood Risk; Return period; Peak-Over-Threshold