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The Changing Risk of Coastal Flooding in New York City from 850 CE to 2300 CE

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In a changing climate, the risk of future coastal flooding depends on both storm surges and rising sea levels. We combine probabilistic sea-level rise projections and large sets of synthetic tropical cyclones downscaled from RCP 8.5 runs of three CMIP5 models to assess the impact of changing tropical storm characteristics and sea-level rise on future coastal inundation in New York City in 2100 and 2300 CE. We compare these future results to a historical analysis of flood risk in New York City based upon synthetic tropical cyclone data sets downscaled from Last Millennium runs of CMIP5 models and proxy sea-level records. Modeling results indicate that there will be minimal change in modeled storm surge heights from 2010 to 2100 or 2300, because the predicted strengthening of the strongest storms will be compensated by storm tracks moving offshore at the latitude of New York City. However, projected sea-level rise causes overall flood heights associated with tropical cyclones in New York City in coming centuries to increase greatly compared to historical or present flood heights. Our projected sea-level rise includes an ensemble of Antarctic projections generated for RCP 8.5 climate scenarios. We find that the 1 in 500-year flood event has increased from ∼2.25 m above mean tide level (MTL) during the period 850-1800 to ∼3.4 m MTL during 1970-2005 to ∼3.9 – 4.8 m MTL by 2080-2100, and to 13.1 m MTL by 2280-2300. Results from this study provide a framework for future risk assessments of coastal flooding in New York City and surrounding communities.