The Impact of Climate Change on New York City's Coastal Flood Hazard: Increasing Flood Heights from the Pre-Industrial 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 modeled storm surges with probabilistic sea-level rise projections to assess future coastal inundation in New York City from the pre-industrial through 2300 CE. The storm surges are derived from large sets of synthetic tropical cyclones downscaled from RCP 8.5 runs of three CMIP5 models. The sea-level rise projections include the collapse of the Antarctic ice sheet to assess future coastal inundation. CMIP5 models indicate that there will be minimal change in 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 pre-industrial or modern flood heights. We find that the 1-in-500-year flood event increases from 3.4 m above mean tidal level during 1970-2005 to 3.9 – 4.8 m above mean tidal level by 2080-2100, and ranges from 2.8 – 13.0 m above mean tidal level by 2280-2300. Further, we find that the return period of a 2.25 m flood has decreased from ~500 years prior to 1800 to ~25 years during 1970-2005, and further decreases to ~5 years by 2030 – 2045 in 95% of our simulations.