



Hurricane flood risk in New York City – a detailed risk assessment of future risks and validation

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Hurricane Irene in 2011 and hurricane Sandy in 2012 showed all too clearly how vulnerable New York City (NYC) and the east coast of continental USA is to the devastating effects of coastal flooding. Total repair and recovery costs caused by Sandy in the States of New Jersey and New York totaled around \$60 billion. The wake of hurricane Sandy has seen a lively debate on how to cope with this now apparent flood risk, and how it may change in the future. In this research, we developed an integrated flood risk model to assess the flood risk to buildings and vehicles by combining more than 500 synthetic hurricane events with the Hazus-MH4 damage model. Risk is estimated on a refined spatial scale for the current situation, as well as for future conditions around 2050 and 2080 by including population growth and climate change. Climate change is included based on synthetic storms using boundary conditions of 4 different GCMs, representing the effect of sea-level rise as well as a possible increase in storm frequency. The effect of uncertainty in storm water levels and damage estimation is also illustrated. The model results are validated using observations of damage caused by Hurricane Sandy in the region, yielding good agreement, giving confidence in the capacities of the modeling framework. The model results illustrate the spatial extent of the flood risk in New York (at the census block level), yielding an aggregate of \$71 million/year for buildings and vehicles (total risk including e.g. infrastructure would roughly be double). The population growth projected by the city will result in a moderate increase in risk (~17%). Climate change, on the other hand, will have a much more profound impact on risk in NYC. Sea-level rise will already have a considerable impact (+60% in 2050s; +150% in 2080s), but coupled with a possible increase in storm frequency, as present in two of the four GCMs, will make for a large increase (+440% in 2050s, +1160%). A future flood risk of up to 12 times the current risk calls for well thought out strategy on how to protect assets, mitigate damages and adapt to changing future conditions.