Engineering Risk Analysis Group
Prof. Dr Daniel Straub

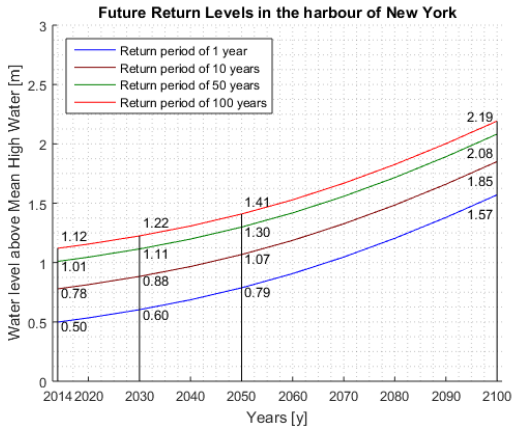
Master's Thesis - Environmental Engineering

Analysis of storm surge risks associated with climate change

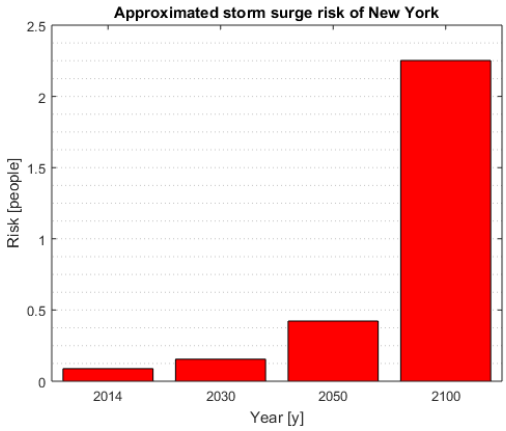
Andrea Reimuth, November 2015

Background

Anthropogenic caused climate change is one of the main future global challenges that will in particular affect coastal regions. The expected resulting rise of the local sea levels but also the projected population growth will influence the risk related to storm surges. This makes it necessary to develop new models, which assess the future changes in the risk, as the starting point of planning potential mitigation strategies.



Current and future return levels at selected occurrence probabilities in the city of New York



Development of the risk to storm surges for the State of New York

Methodology

In this thesis a quantitative risk analysis model is developed and tested at the State of New York:
Based on the statistical evaluation of measurement data the current storm surge frequencies are derived. Global sea level rise projections are evaluated to predict the future regional changes. The inundation area is modeled using a Digital Elevation Model. The exposure to the population is estimated from census data. The vulnerability to storm surges expressed as the mortality due to the physical impacts of flooding is estimated empirically.

Results

The model gives a good estimate of the development of the risk due to climate change and enables the localization of areas at higher risk.
However, the uncertainty introduced by the prediction of the global sea level rise has high influence on the future risk, especially in the second half of the 21st century.
Further tests have to be carried out with a better quality and a lower resolution of the elevation model to check the applicability to small-scale studies and the sensitivity against regional specifics.

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