TU Delft

Offshore & Dredging Engineering

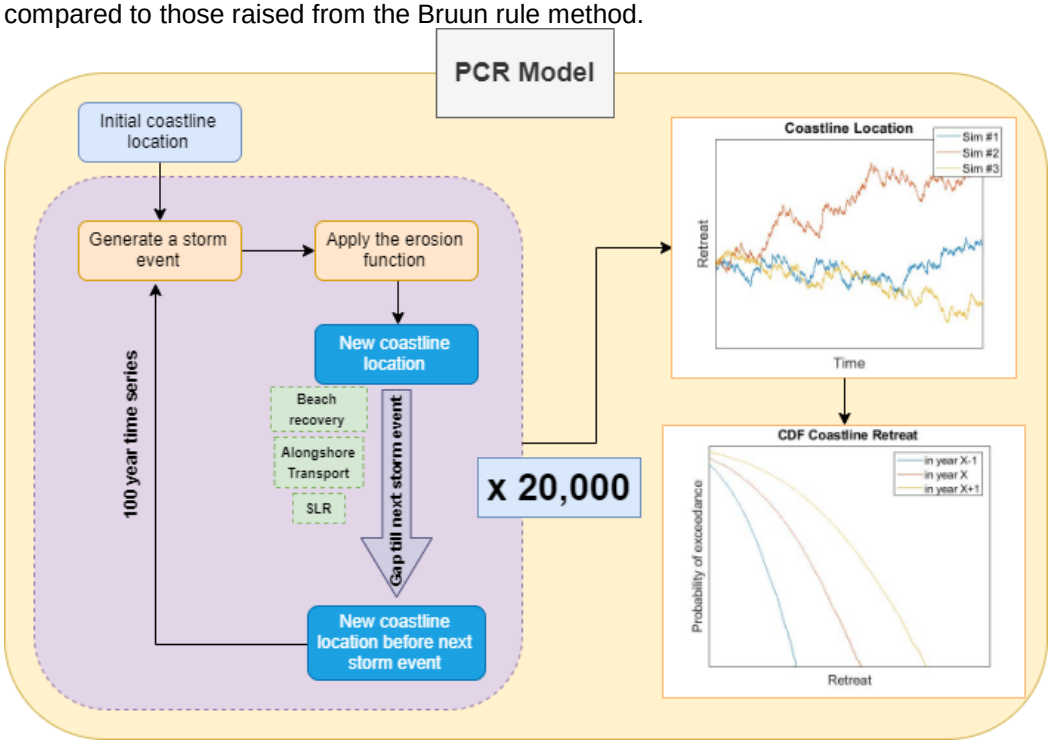
Technische Universiteit Delft

Estimating future coastline changes along Holland coast, under different sea level rise scenarios, using a probabilistic approach

Due to climate change and sea level rise (SLR) the coastal zones are getting exposed to increasing risks like coastal recession, putting in risk human lives and billions of dollars worth of coastal infrastructure. Low lying countries like the Netherlands are considered more vulnerable to the effects of sea level rise. Large parts of the Dutch coast have been eroding for centuries and nourishments schemes of approximately 12 million m^3 have been implemented annually in order to maintain the coastline as it was in 1990. However, the future dune erosion will further increase due to the impacts of climate change and hence the adaptation strategies should be in line with the accelerated sea level rise and the possible effects that may bring.

The most commonly used method to assess sea level rise impacts on shorelines is the Bruun rule. However, nowadays the coastal zone management requires a stochastic approach to estimate coastal retreat. Bruun rule's deterministic nature cannot align with the risk-based framework of coastal zone management. This necessity initiated the development of a process-based model, the Probabilistic Coastline Recession (PCR) model, estimating the future coastal recessions in a probabilistic approach.

In this research, the PCR framework was applied at eleven locations along the Holland coast, in the Netherlands, under three different SLR scenarios. The availability of coastal profile data (from 1965 until now) and coastline position data (from 1843 till 1980) made the Holland coast an ideal location to explore and extend the applicability of the PCR framework. The most relevant assumptions for this coast were identified and explored. The recovery rate of the dune was a weak point of the PCR model and Holland coast was an interesting area to be tested. Three approaches of calibrating the *natural* recovery rate of the dunes were followed. In addition, the alongshore sediment transport which was assumed negligible to the previous case-studies, in this work it was integrated into the PCR model. Projected recessions on the period 2020-2100 have been made using the updated PCR model for the SLR scenarios RCP4.5, RCP8.5 and Deltascenario, based on the most landward position of the coastline in each year. Finally, the results were compared to those raised from the Bruun rule method.



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