Assessing the storm vulnerability of the Belgian coastline

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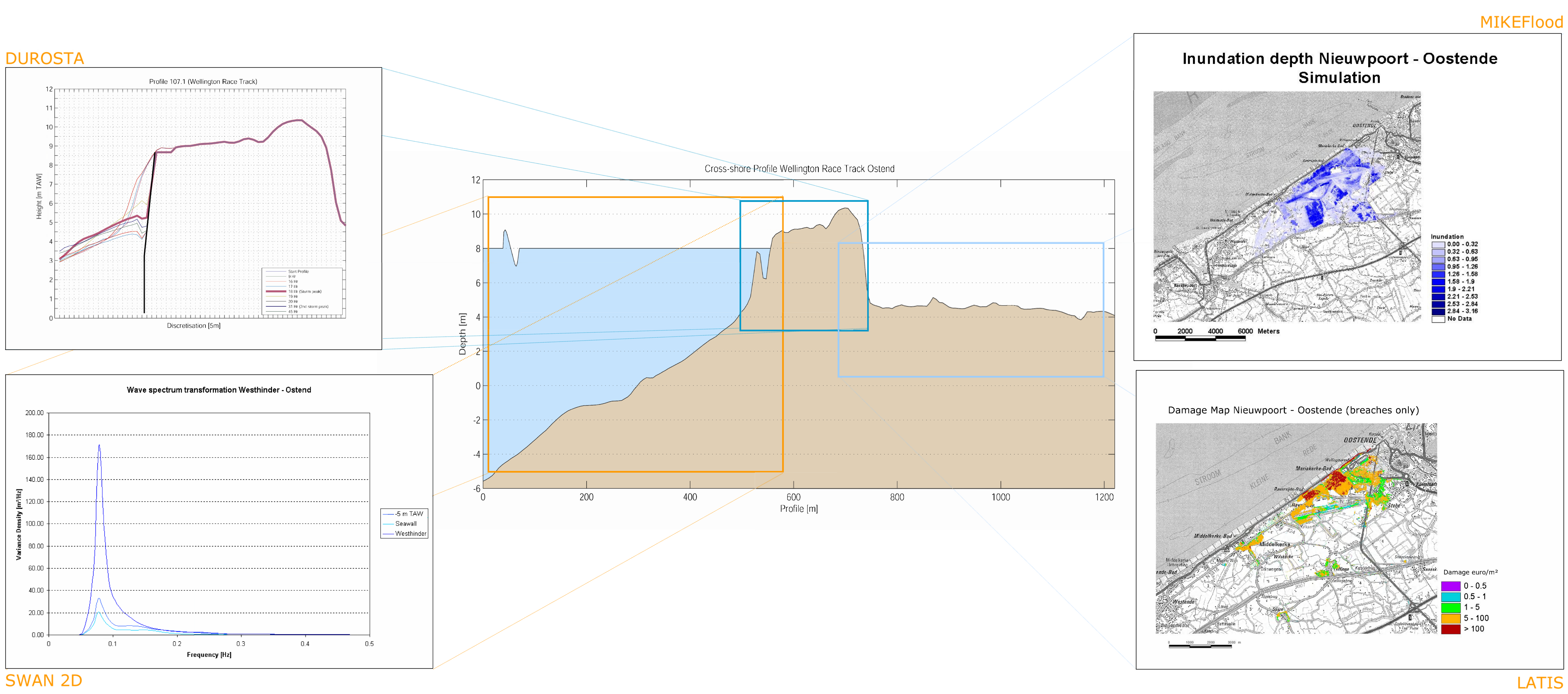
Introduction

Coastal flooding risk calculations are carried out for the entire Belgian coastal zone to support the management of the coastal defence system. The floodprone low-lying coastal area has a width up to 15 km and is located on average 2 m below the surge level of an annual storm. The natural sea defences are sandy beaches and dunes, which have been strengthened by revetments in the coastal towns and harbours. The Belgian standard of coastal protection is to be safe against a surge level with a return period of 1000 years, but at present it is investigated if and how this standard could be redefined based on risk analysis.

Research methodology

The emphasis of the risk calculations is on the breaching probability of the sea defences. The flood damage is very sensitive to the number of breaches in the coastal defence system. For a given storm surge the response of the system is modelled as a chain of models for wave propagation, beach erosion, wave overtopping, structural failure of the revetment, erosion of the core and finally breach growth. Wave propagation of deep water conditions to the nearshore is modelled with the freely available open software SWAN (Booij et al., 1999). Beach erosion is modelled with the time-dependent process model DUROSTA (Steetzel, 1993). Wave overtopping is modelled using the state of the art as given in the European Overtopping Manual (2007). The same reference is used to assess the critical overtopping discharge resulting in structural failure of the revetment. Erosion of the core and breach growth is modelled using the parameterisations of respectively Visser (2002) and Verheij (2002). Flooding simulations are performed with the commercial software MIKEFlood. Finally, direct economical damage and potential human casualties are calculated using the Flemish method which is developed by Flanders Hydraulics Research and Ghent University, and implemented in the software package LATIS (Deckers et al., 2008). All the submodels are currently being calibrated to obtain reliable and comparable results.



Conclusions and future work

An overall flood damage analysis for the Belgian Coast is presented. The results of this analysis will be used to calculate the risk associated with certain calamities. As such, the consequences of different management scenarios can be modeled in a quantitative way. Combining these with a social cost benefit analysis, will yield the optimum protection alternative in the framework of integrated coastal zone management.

References

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