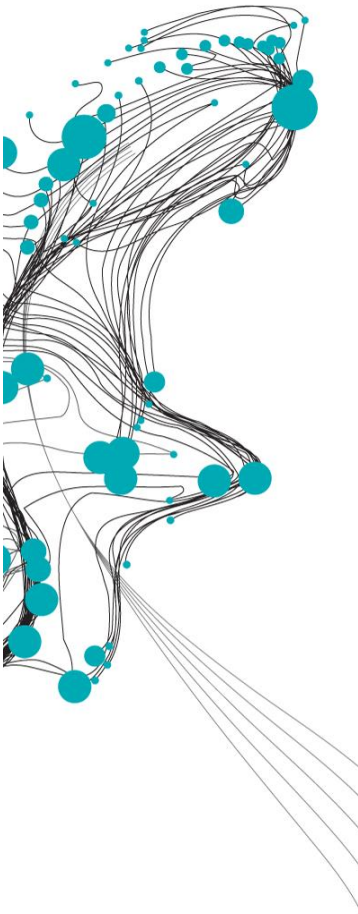


OPERATIONAL STORM IMPACT FORECAST INFORMATION FOR THE COAST

DESIGN, IMPLEMENTATION IN MORPHAN AND EVALUATION OF AN OPERATIONAL COASTAL STORM IMPACT APPLICATION



Dunes protect a large part of the Dutch coast against flooding from the sea. Although most storms will not cause failure of this sea defense, they may still cause a threat to, for instance, seaside towns because of dune erosion and overtopping. Also, high waves and current velocities near the shore may cause damage to coastal structures or property on the beach. Currently, weather, water level and wave forecasts provide coastal managers with timely information about the severity of an approaching storm, but the damaging effects to be expected of that particular storm are usually unclear. Despite ongoing research, no early warning system which incorporates storm impact assessment is currently available at water authorities. In this study, an operational, quick, flexible and easy to use storm impact application is designed, implemented in MorphAn and evaluated. MorphAn is a computer program that is already used for dune assessment and other coastal related analyses by coastal water authorities and Rijkswaterstaat.

Three main components are coupled in the storm impact application. These are bathymetry data, water level and wave data as well as an XBeach model. Real-time water level and wave forecast data from Rijkswaterstaat with a 48 hour lead time is retrieved for the location of the chosen bathymetry data. The bathymetry and water level and wave data is automatically fed into the XBeach model, which calculates the hydrodynamic and morphologic processes during the storm.

The storm impact application in MorphAn provides a Graphical User Interface (GUI) where a user takes several steps in order to obtain a result that provides insight in the effects of the approaching storm on the coast. These effects are for instance dune erosion or breaching, damage of property, high current velocities near the shore and overtopping of dunes or structures. Coastal managers can directly use this result for communication purposes, as well as for decisions about beach and hinterland evacuations or protecting measures of sea dikes or dunes.

The quality of the storm impact application is evaluated with the criteria Speed, Relevance, Understanding, Robustness and Evolvability. The results that are provided by the storm impact application are evaluated with the criteria Accuracy and Performance. The uncertainties of the different bathymetry sources, water level and wave forecasts as well as the XBeach model are assessed. A sensitivity analysis of these uncertainties provides information about their effect on the result, to be taken into account in decision making.

Evaluation of the seven criteria provide a promising outlook for operational practice and further development of the application. Concluding, an operational, quick, flexible and easy to use storm impact application is now available for operational practice.

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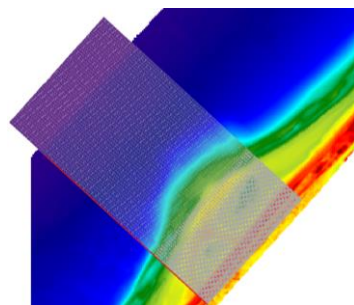


Figure 1: GUI interface where the XBeach grid is generated with interpolated values from the bathymetry layer.

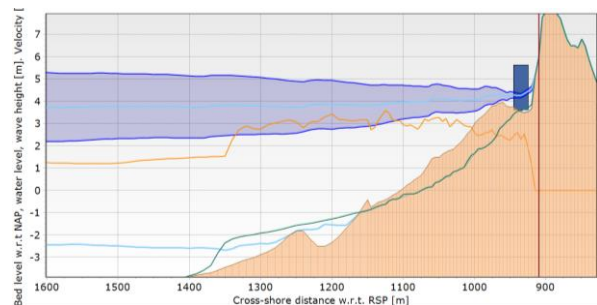


Figure 2: XBeach result with the minimum and maximum water levels during 72 hours (tides and set up, light blue lines), the maximum wave heights (dark blue area), the maximum absolute velocities (orange), the initial bed level (sand colored area), the eventual bed level (dark green), the water set up line (dark red) and buildings (dark blue square)