Impact Assessment

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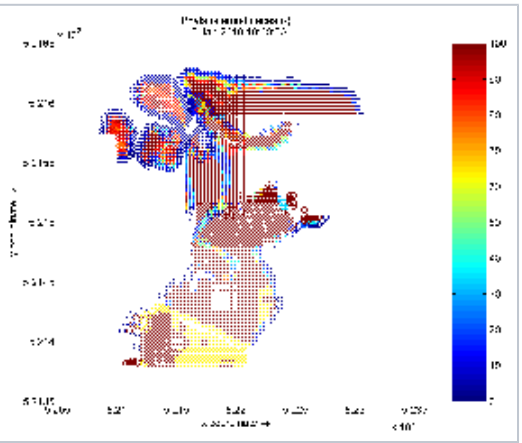
Impact Assessment tools consist of numerical models, viewers and methods that can be used to assess the impact of certain interventions on the system. Some tools are more global and general, which can be used for quick assessments, whilst others are detailed modelling tools aimed to assist decision-making.

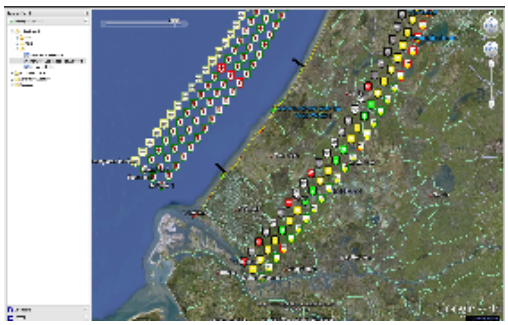
Biogeomorphological Coastal Modelling System (Delft3D)

The biogeomorphological coastal modelling system aims to describe and predict biogeomorphological processes and their response to human interventions in the system of interest. Thus one can identify possibilities to make use of such processes, as well as new opportunities for nature associated with the infrastructure to be developed. Combined with a good understanding of how the system functions a biogeomorphological model enables credible predictions, not just of a single aspect like morphology, safety, ecology or biology, but of the combination including the effects of mutual interactions.



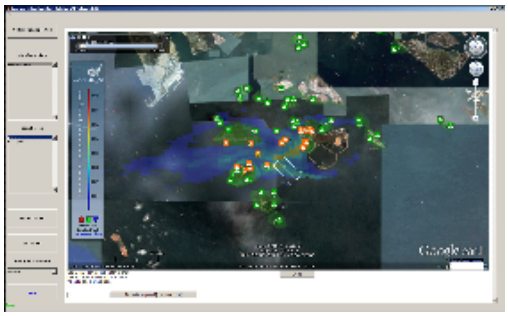
Coastline intervention tool - Holland Coast (ITHC)

The Interactive Design Tool for the Holland Coast (ITHC) is a MapTable application aiming at assisting decision makers, project developers and stakeholders in the early development stages of coastal maintenance strategies for the Holland Coast. The Holland Coast, i.e. the coast of the provinces South-Holland and North-Holland, the Netherlands, is a sandy dune coast characterized by a wide variety of economical, ecological and recreational functions, hence a large and diverse group of (potential) stakeholders. For the successful implementation of coastal maintenance strategies, the support of these stakeholders is of vital importance. With the Interactive Design Tool users can easily and rapidly evaluate the consequences of various coastal interventions (e.g. nourishments, coastal structures) for indicators such as coastline development, dune development and habitat suitability. The tool has the ability to evaluate (mutual) interactions between new interventions and existing coastal structures in both space (small- vs. large-scale) and time (short- vs. long-term). This enables users to get insight into the consequences of their choices, to determine their position, and to provide input into the design process.



Interactive Dredge Planning Tool - Singapore

Dredging and other human-induced increases in turbidity levels and sedimentation rates may impact coastal ecosystems such as coral reefs and seagrass meadows. The Interactive Dredge Planning Tool (IDPT) is able to perform a rapid assessment of the expected, initial ecological effects caused by interactively defined dredging operations. For this, the IDPT makes use of rapid assessment dredge plume modelling, a database with computed hydrodynamic background conditions and a database with ecological information, i.e. locations, species and species tolerance information. The effect of this increased turbidity and sedimentation on the ecosystems is site and species specific, but has been addressed for certain species in Singapore in different projects within the Building with Nature programme.

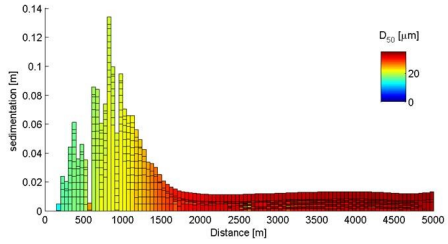


Interactive group modelling - MapTable

The term MapTable refers to both hardware and software that function as a design and decision-support tool. The MapTable hardware consists of a large, potable touch-screen design table that can be used as an instrument in spatial planning processes. MapTable software is an umbrella term for software that is suitable for use together with a digital design table. MapTables can be used for interactive design processes with stakeholders, and can assist in visualising potential problems and solutions. This tool page focuses on explaining the MapTable concept and software, including spatial databases and models that can predict impacts of designs of construction works for these projects.

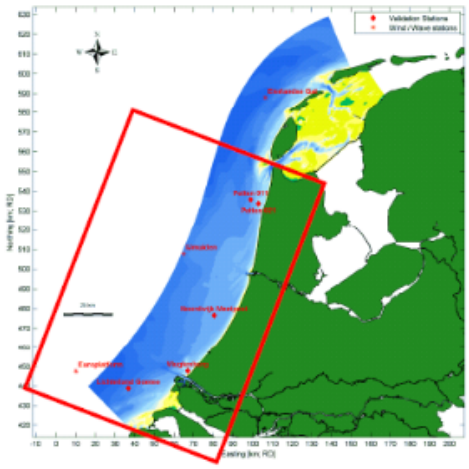
Morphological predictor for mixed beds

A sand-mud bed composition module has been developed to predict of bed level and composition changes as computed from deposition and erosion of multiple sediment fractions. Depending on the mud fraction, the bed may behave cohesive or non-cohesive, resulting in different erosion behaviour. The bed module consists of multiple layers and may include mixing by bioturbation or bedform migration. The bed module is open-source.



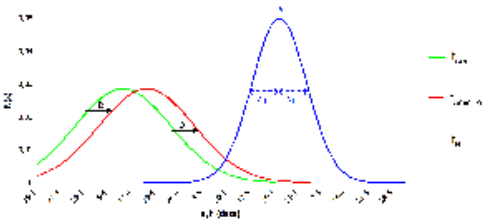
Nearshore wave transformation table

The Wave Transformation Table is a look-up table to quickly obtain elementary wave parameters (i.e. significant wave height, peak period and direction) nearshore. This information can be relevant to any type of coastal and offshore engineering or marine ecology study in which waves are important, especially if nearby wave measurements are missing, too expensive or too time-consuming. The tool is available both as a web application and as a Matlab application. The look-up table only covers the Holland Coast, but in principle the technique can be applied to nearshore areas anywhere in the world (provided that sufficiently long offshore wave time series are available).



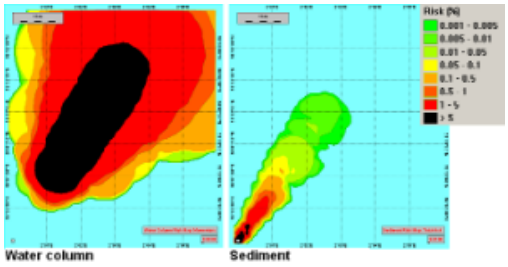
Probabilistic analysis of ecological effects - Cause-effect chain modelling

The quantification of ecological effects in Environmental Impact Assessments is mostly done by deterministic modelling of cause-effect chains. However, with these cause-effect chains are subject to a large number of uncertainties. Part of them are inherent to natural dynamics, others are caused by a lack of knowledge on the relevant processes. In a deterministic approach these uncertainties cannot be taken into account and worst-case assumptions have to be made. The accumulation of worst-case assumptions will yield highly conservative estimates of the ultimate effect with an unknown uncertainty margin. A probabilistic approach treats uncertainties in a different way, which enables incorporating the most relevant ones in the modelling of the ecological effects. A probabilistic approach leads to insight into the probability of occurrence of the possible effects, which can be of use in discussions about the design of the project or the necessity of mitigating and compensating measures.



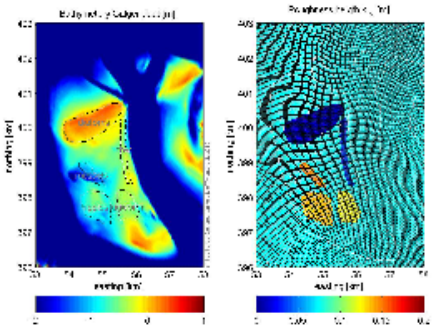
Probabilistic effect analysis - The Species Sensitivity Distribution

To assess the environmental impacts of human interventions, species indicators can be useful to evaluate the effects of different designs. The so-called Species Sensitivity Distribution (SSD) uses causal relationships between exposure level and effect level of individual species. By using exposure-effect data of multiple types of animals and plants, the sensitivity distribution of these species can be used to assess the risk of human interference more quantitatively. Although the SSD was originally developed to assess the ecological risk of toxicants, it also appeared to be applicable for non-toxic stressors. For instance, SSDs have been developed specifically for assessing the risk of suspended clay-particles and sedimentation for the environmental impact analysis of offshore oil and gas drilling activities. One advantage of having SSDs for non-toxic stressors is that they can be easily combined with those of toxic stressors, resulting in a single impact indicator - although such combinations remain to be fully validated.



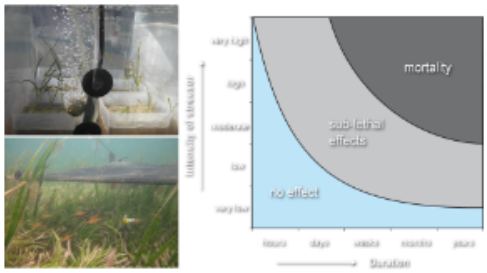
Roughness module for sediment dynamic modelling

The bed roughness tool, a mathematical model, can be a useful instrument for hydraulic engineers to quickly set up a bathymetry with a variable roughness of the surface. Sedim ent dynamics in the intertidal area are the result of the complex interaction between hydrodynamics and biological activity. Bed roughness is one of the most important and difficult parameters to quantify in order to model the hydrodynamics and sediment dynamics. Bed roughness can be generated by physical characteristics (ripples, sediment grain size) and by benthic organisms that modify the surface. The roughness tool can be used to reproduce the hydrodynamics based on both physical and biological processes.



Species Response Curves for Seagrass

This tool explains in general terms how seagrass responds to environmental conditions, specifically to reduced light penetration, which is one of the most severe threats for seagrass ecosystems worldwide. Such information is especially useful if planned infrastructural developments are expected to lead to (temporary) changes in environmental conditions in nearby sensitive ecosystems, e.g. dredging operations near coral reefs, mangrove forests or seagrass beds. The tool may give information on negative ecological impacts that may be expected from infrastructural developments, when and to what extent these impacts are expected to occur, to what extent negative impacts are reversible, and when managers, planners and constructors are to take precautionary measures to prevent irreversible damage. Information is provided on how to develop species response curves using lab and field experiments, and is therefore transferable to other species.



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