Deltares

Enabling Delta Life

Coastal Engineering

The coastal engineering group of Deltares assists clients implementing coastal infrastructure all over the world. Deltares is a leader in this field because of our unrivalled experience, our ability to mobilise large multi-disciplinary expert teams, and our world-leading methods to deal with even the most complex coastal engineering issues. With our advanced software and laboratory facilities we are especially well equipped to help clients to optimise a design and to find solutions, identify impacts, reduce costs, and to deal with safety issues and permit applications.

Working in the coastal area

Land reclamations, islands, beach design, coastal protection, landfalls, dredging strategy and impacts: the success of any project undertaken in the coastal zone relies on in-depth understanding of the local environmental conditions, the relevant natural processes, and human activities. The coastal engineering group provides this broad knowledge based on understanding of currents, waves and sediment behaviour, and insight in important aspects of coastal structures, construction processes and dredging, which they gained during more than 80 years of consultancy work and dedicated research projects.

Our services range from quick assessments to detailed evaluations and project support on all aspects of a client's plan based on numerical and physical modelling studies.
One of our strengths is that our advice can be provided in a multi-disciplinary approach including other project aspects such as water quality, ecology, navigation, geotechnical issues and management policy.

The high quality and value of our advice, quick responses, and our close cooperation with clients in projects is highly appreciated and recognized around the world, resulting in our involvement in prestigious projects such as the Dubai Palm projects, Hong Kong International Airport land reclamations, the Venice Inlet Flood Barriers, and the Dutch Rotterdam Port Expansion Maasvlakte II.

Study activities

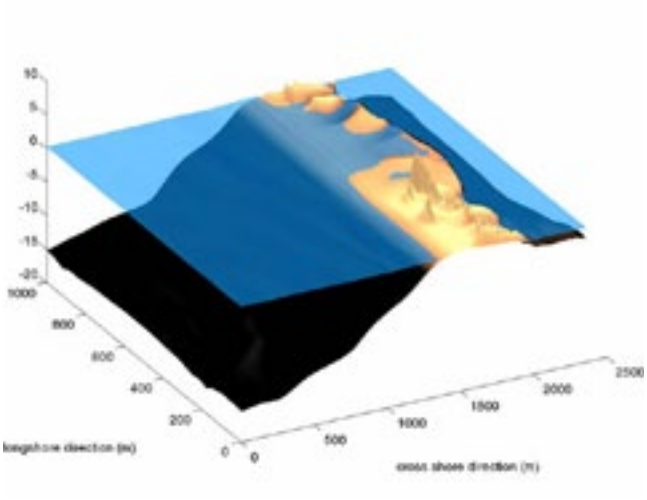
Environmental conditions

Starting from the feasibility study of a coastal project, the local environmental conditions are key input to determine the geometry, impact and maintenance of the project. Deltares sees the assessment of local environmental conditions as one of its key topics. It involves the operational and extreme statistics of, for instance, wind, waves, water level and currents, which are assessed by means of extensive data analysis and hydrodynamic modelling. Our added value is that we can review the quality of the assessed conditions on the basis of our long-standing world-wide experience in this field. This allows us to observe trends due to global warming or changes during the operational phase, such as nearby dredging or construction activities.

Coastal development and protection

In-depth knowledge of the relevant physical processes and understanding of the behaviour of the coastal system form the basis for all our coastal erosion projects.

Starting point is always a thorough analysis of the possible causes for erosion or sedimentation. With these causes well established, predictions of future coastal behaviour can be made and recommendations for mitigating measures can be given. In-house developed modelling software (such as Delft3D and UNIBEST) is often applied to support these predictions and to design coastal protection schemes. For each study the most suitable model is selected, based on our judgement of the dominant physical processes and the complexity of the situation.



Knowing that any interference with the sand balance in the study area may (adversely) affect other parts of the coastal system or the marine ecology, the impact on adjacent coastal sections is taken into consideration in the evaluation of options for coastal protection schemes. Evaluations may in some cases result in recommendations for 'soft measures' (beach maintenance plans), sometimes for 'hard measures' (structures like groynes, detached breakwaters, etc.). Our mathematical two- and three-dimensional morphological models are used to assist in evaluating the effectiveness and optimisation of such schemes.

Beach development

As part of the development of recreational resorts often design of new beaches (or the improvement of existing beaches), based on the principle that new beaches must remain relatively stable, safe and healthy, and that they

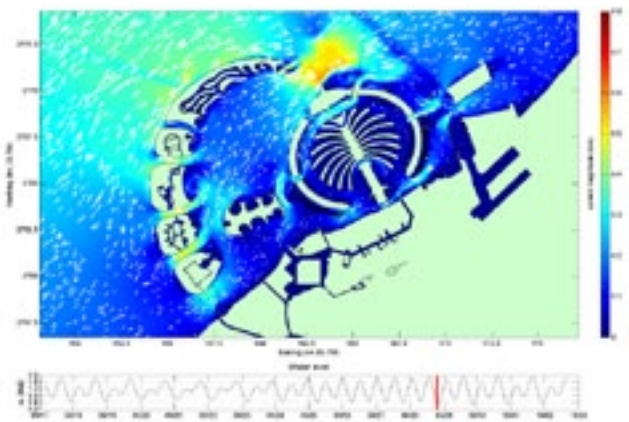
should not adversely affect the surrounding coast. We are able to provide recommendations on beach shape and overall orientation, beach slopes, and – if relevant – on required structures to minimize sand loss. Such recommendation is often supported by numerical modelling or, in some cases, by physical modelling. If maintenance of the beach is envisaged, a beach maintenance plan can be developed accordingly.

Island and land reclamation

Deltares has been involved as a key player in the development of many recent island or land reclamation projects in the world, such as the extensions of the port of Rotterdam and Hong Kong Airport, and all of the major island development projects in Dubai. Our expertise covers a wide variety of topics, including the design of seawalls, beaches and marina entrance configurations, reclamation levels, water refreshment and quality issues, nautical aspects, ecological and morphological impacts. By giving timely and accurate advise on the whole of these topics, Deltares has proven to position itself as the pivot of the team of developers, architects, masterplanners, consultants, dredgers and contractors.

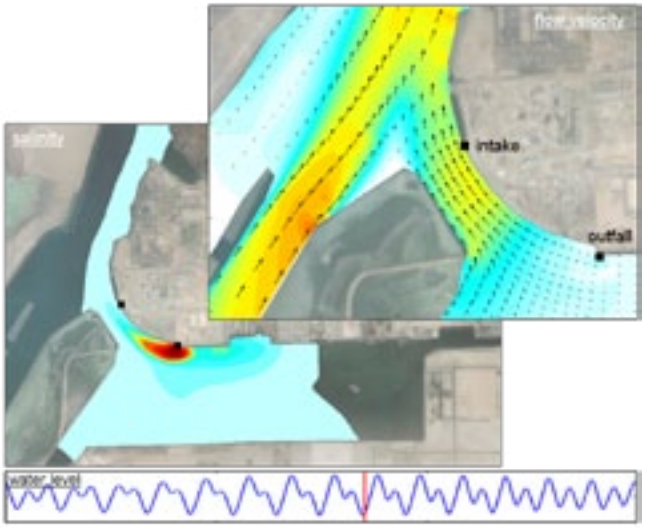
Channel siltation and dredging strategies

The sedimentation of channels and siltation of port basins can lead to significant effort in maintenance dredging. Predictions of sedimentation rates in channels and basins can provide valuable information to assess the required dredging activities. Our numerical morphological models can predict short-term and long-term sediment transport for dredging scenarios over decades of port operation. Applying such models leads to optimisation of dredging operations for port and entrance channel maintenance and consequently to more economical designs.



Dredging plume assessment

During dredging and reclamation activities, fine sediment particles are released in the water column and can be transported away from the dredging site by the currents. While still in suspension or by deposition, the released sediment can affect sensitive marine habitats in the area around the dredging site. Based on a combined near- and far-field modelling approach, we are able to quantify the transport and deposition of the fine sediment particles under varying ambient conditions and for different phases of the dredging operations.



Recirculation assessment (intake-outfalls)

Most large industrial plants are situated in coastal areas, where they withdraw cooling water from the same environment in which they discharge their wastewater. In order to prevent or minimize the recirculation of wastewater from the outfall back into the intake, or those of neighbouring plants, insight in the (often very complex) near- and far-field flow patterns in the area is essential. Deltares can provide integral assessments of recirculation in coastal zones, by using sophisticated near-field modelling (e.g. CorMix) coupled to far-field modelling (Delft3D-FLOW). Typical results of these assessments are optimised designs for the intake/outfall layout and (environmental) impact assessments.

Landfalls

In the coastal zone it is common that pipelines and cables landfall, connecting offshore platforms with the mainland. For a safe installation of the pipe, such a landfall often requires temporal construction activities in the coastal zone. These activities may involve a dredged

trench to place the pipeline, construction of a cofferdam, etc. With use of our morphological models, we are able to make short-term predictions on the coastal changes at site and hence sedimentation rates in the exposed trench. Aspects like safety on the coastal defense system can be assessed as well for the considered construction period.

Research and Development

Deltares has strong lines of research and development on several key topics related to Coastal Engineering. Frequent interactions with clients and users of our services and software yield continuous research questions and development of new approaches and tools. Strong relations with universities (especially Technical University of Delft) result in combined research efforts and state-of-the-art knowledge on several key topics in Coastal Engineering. As a result of these research efforts, useful developed knowledge is continuously fed back into our software packages.

Methods and approaches

Either a numerical, physical or a combined modelling approach can be the most efficient way for obtaining the information required for a project. In every project a tailor-made approach is determined, depending on the client's questions. Deltares has state-of-the-art tools and methods for both physical and numerical study approaches. If needed, Deltares can give advice on monitoring techniques and survey specifications or can carry out monitoring / survey campaigns.

Numerical models

Our primary software tools are embedded within the packages Delft3D, CHESS (which includes SWAN-UI, PHAROS, UNIBEST) and Delft Waves. Many modules are standalone packages that are commercially sold while others are used for our own study purposes. Among the commercial software is the entire Delft3D suite of models which include sophisticated wave, 3D-flow, morphology and water quality modules with efficient communication between modules in a user friendly environment.

Physical models

The main physical modelling facilities for coastal infrastructure include:

- Delta Flume, for large-scale regular and irregular waves, 240m long, model waves up to 2.5m high;
- Schelde Flume, glass wall wave flume, 110m long;
- Vinje Basin, multi-directional wave basin, 50X50 m;
- Atlantic Basin, for wave-current interactions, 75m long, 8.7m wide.

Our clients

Our clients represent the broad base of national and international organisations. In The Netherlands we value highly our close interactions with Dutch ministries, local authorities, Dutch contractors and Dutch consultants as these provide some of our greatest and most interesting challenges. Our international client base includes government authorities (ministries, institutes etc.), local authorities (municipalities, provinces), consultants, contractors and private industrial clients and developers.

Further information

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