

The role of sandwaves in the management of the Netherlands Continental Shelf

Ad STOLK

Ministry of Transport, Public Works and Water Management, North Sea Directorate, P.O.Box 5807, 2280 HV
Rijswijk, The Netherlands.
Fax.: (31) 70 3900691
Email: a.stolk@dnz.rws.minvenw.nl

Abstract

Part of the Netherlands Continental Shelf is covered with sandwaves. Their dynamic behaviour varies over the shelf. Besides their importance as an interesting morphological feature sandwaves play a role in the managing of activities concerning the sea floor. Especially the dynamic behaviour of sandwaves has an interaction with activities like maintenance dredging, construction and maintenance of pipelines, sand mining and detection and recovering objects on the sea floor.

1 Occurrence of sandwaves

The seafloor of the Netherlands Continental Shelf south of 53 N is for a large part covered with sandwaves (Van Alphen and Damoiseaux, 1989). In the central part of the sandwave field the height can reach 12 metres. To the north and in coastward direction the height decreases. Off the coast of central Holland the height decreases from 8 metres near the approaching channel to Rotterdam harbour to 3 metres north of the island of Texel. In this direction the symmetry of the sandwaves increase from almost symmetric in the south to a clear asymmetry in the north.

On the migration of sandwaves only a few datasets are available. In general there is an oscillation of sandwaves with a net migration to the north off Hoek van Holland. North of Texel a (non steady) migration in one direction is observed. Near the Brown Bank areas with stationary sandwaves are found (Van Maren, 1998).

Not only the long term net movement of sandwaves, of several metres per year, is important. The temporary short term movements, both in a net direction or as an oscillation, can have a large impact, because they can be up to tens of metres per year.

2 Maintenance dredging

To maintain the depth of the approaching channels to the harbours of Rotterdam and Amsterdam dredging is necessary. Because the approaching channels cross sandwave fields dredging is often pointed to the crests of sandwaves. Insight in the vertical growth of sandwaves after dredging is important to optimise the frequency of sounding and dredging and a better risk assessment for the access of very large ships. Knowledge of the lateral migration is important to determine the input of sand in the channels due to dynamic sandwaves.

The prediction of vertical growth of sandwaves is also important for plans to deepen the area around the channels to make it possible that larger ships can approach the harbours outside the channel.

3 Pipelines

For the construction and maintenance of pipelines for oil and gas behaviour of sandwaves is crucial. Pipelines which cross sandwave fields can be damaged when the migration of sandwaves lead to a undermining of the pipeline. When the freespan becomes too large or remains too long the pipeline can be broken causing severe environmental and economical damage. Also problems occur when an exposed pipeline is hit by fishing gear.

Understanding of the dynamic behaviour of sandwaves lead to a better design for pipelines, concerning the trenching depth, and a greater safety for fishing-boats.

Especially in the northern part of the Netherlands Continental Shelf the migration of sandwaves is relevant for pipelines.

4 Sand mining

Knowledge of sandwaves is interesting for sand mining by two ways.

First, the properties of the sand, like grainsize and sorting are important. In the Netherlands there is a need for sand for concrete. The crests of sandwaves could be of the right composition for this purpose.

Second, the dynamic behaviour of sandwaves is important for the selection of sand mining areas and the design of sand pits. Large reclamation plans in the Dutch coastal area require huge amounts of sand, up to hundreds of millions of cubic metres. Plans to excavate large areas of the seafloor give rise to questions as: do sandwaves re-

establish in an excavated sandwave field; can sandwaves develop in areas where no sandwaves exist before the excavation.

The (re-)establishment of sandwaves after sand mining influences the hydrodynamic processes and the recolonization of the benthic fauna.

Conclusion

On the Netherlands Continental Shelf maintenance dredging, pipeline construction and sand mining are important activities. For the management of these seafloor related activities insight in the nature and dynamics of sandwaves is necessary. There is special interest in the prediction of vertical growth and lateral migration to optimise regulating and execution of these activities in a economic and environmental sound way.

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