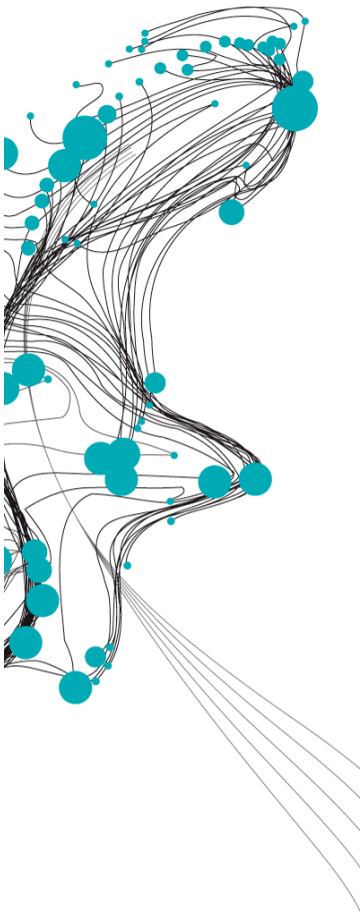
SAND DUNE BEHAVIOR PREDICTIONS FOR DREDGING APPLICATIONS



Located at the confluence of several major Western-European rivers flowing into the North Sea (Rijn-Maas-Scheldt delta), the flat and low-lying conditions of the Netherlands are suitable for the development of sand dunes. These bedform patterns vary both in spatial and temporal scales according to the hydraulic conditions and their continuous development and migration could interact with human activities. Being able to predict these riverbed patterns is of great importance for the maintenance of the minimum draught levels of rivers to ensure navigation.

In collaboration with the external company De Vries & van de Wiel (DEME-Group), a case study in the river system placed within the Rijn and Maas tidal areas (West-Nederland Zuid) aims to explore the characteristics and progression of the river sand dunes and develop a tool to forecast their morphological behavior. The approach is made by calibrating a dune evolution model to the area conditions.

According to the model limitations, the study focuses on two different properties areas located at the Beneden Merwede (BEM) and the Boven Merwede (BOM), where sand dunes develop. The former comprises a straight river segment within a groyne field while the later lays at the inner bank of a river bend. Both areas present a predominant seaward uni-directional flow with diurnal discharge variations due to the perceived downstream sea-boundary tidal effects. A manually collection of the sand dunes' characteristics through consecutive survey periods allows to study the dunes' migration and growth rates, getting an insight on which and to what extent are the most important processes involved in their behavior patterns.

The dune evolution model of Van Duin (2017) is applied and calibrated in both areas, capable of reproducing the observed dune heights development, Figure 1. Nonetheless it fails to properly predict the hydrodynamics and underestimates the water depths. The varying conditions in both areas resulted in two different models and scaling relations with slightly different parameters. The developed tool is capable to provide a range of possible dune heights and migration rates. A performance analysis determined that considering monthly averaged discharges the models still predict a proper dune development. The particular characteristics of BOM suggest that its final calibrated model is very specific to the area, limiting its use to other non-equally locations, whereas the more common and englobing characteristics of the BEM area make its supposition and incorporation into the rest of the project area more feasible.

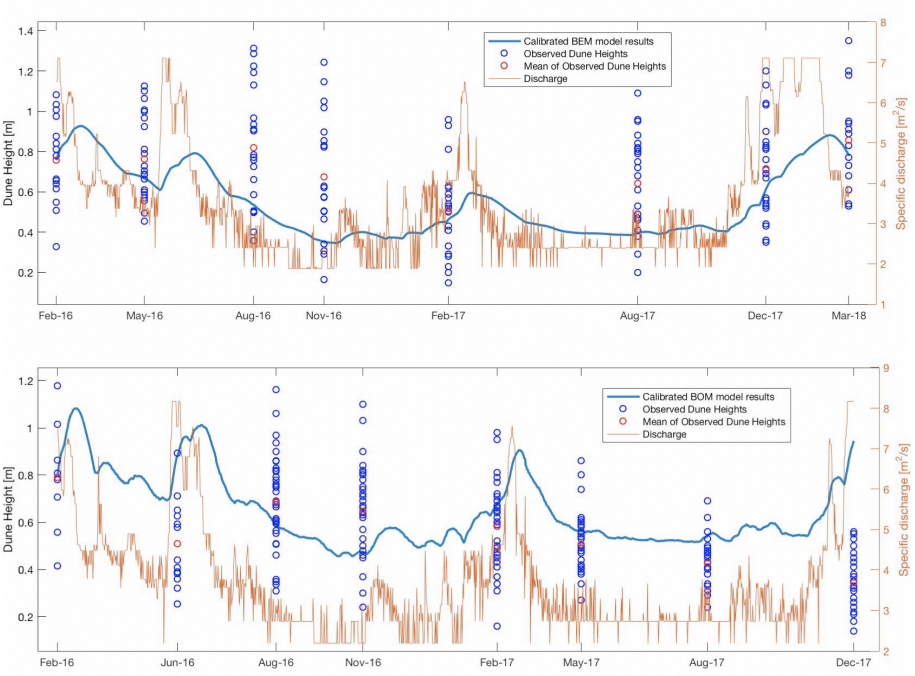


Figure 1: Model simulated dune height evolution and surveyed dune heights. BEM Area (top) and BOM Area (bottom)

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