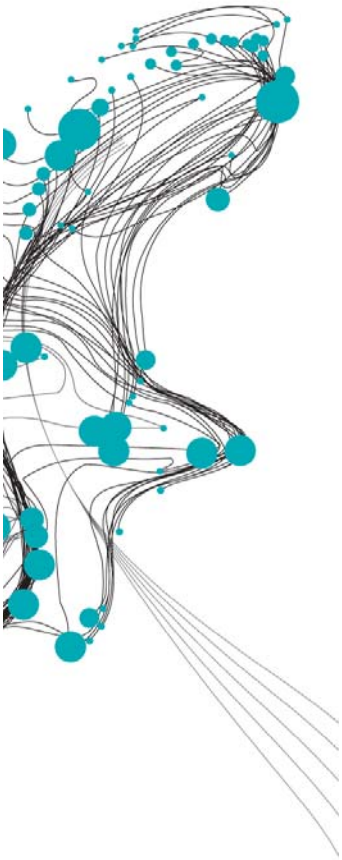
REGENERATION OF TIDAL SAND WAVES AFTER DREDGING

FIELD DATA ANALYSIS, MODEL SIMULATIONS, AND SYNTHESIS TO ENGINEERING APPLICATIONS



Shallow sandy seas like the North Sea are covered in a variety of bed forms. Sand waves are one example of these bed forms, and they can reach heights of meters and wavelengths of hundreds of meters. These bed forms have shown to migrate and the combination of their size and the migration can cause threats and challenges to offshore infrastructure.

This study focuses on the regeneration of these tidal sand waves after dredging and is split into two parts. The first part assesses the performance of a numerical model by comparing the model results to regeneration of sand waves in a study site. The second part focuses on modelling the regeneration of sand waves for different dredging strategies.

A sensitivity analysis on the environmental input parameters corresponding to this study site showed that the tidal current velocity amplitude is the most sensitive and a large sediment grain size proved to limit the effect of other environmental parameters. For the long-term bed development, three different initial beds are implemented:

- Original small amplitude sine function to represent a dredged seabed (Case I)
- Schematized sine function with larger amplitude to represent an undredged bed (Case IV)
- Idealized initial bed extracted from field data (Case VII and VIII)

Figure 1 shows the results of the wave heights from the field data (A) and from the different initial beds (B). Different wavelengths are present on the idealized initial bed; therefore a fundamental error is made where the forcing of the system cannot match all wavelengths present in the system. This results in a preference of the original or schematized initial bed over the idealized initial bed.

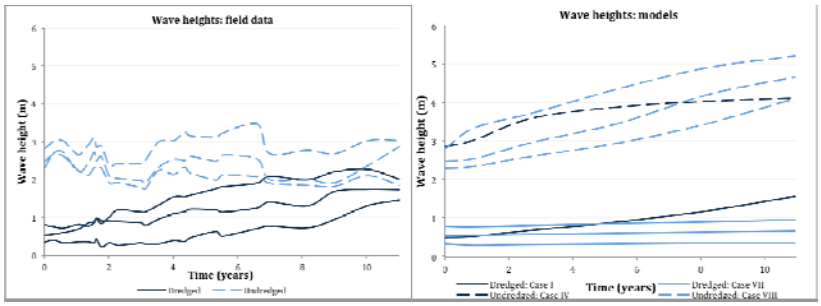


Figure 1: A. Wave heights from field data *B. Wave heights from models*

Three different dredging strategies are implemented in the model:

- Peak removal (full, 2/3 and 1/3 of the peak)
- Cut & Fill
- Total Removal

Figure 2.A shows the implemented dredging strategies and Figure 2.B shows the wave heights of the sand waves right after dredging until 5 years after dredging plotted on the general growth curve. It is found that the growth curves and the trends of the growth rates of sand waves after dredging similar to the growth curve and trend of an undisturbed sand wave in that area.

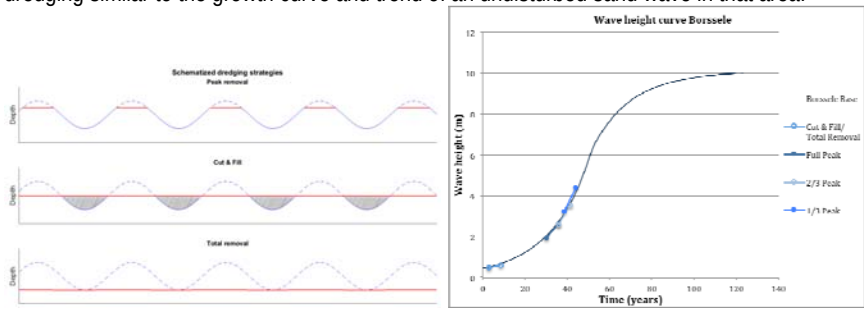


Figure 2: A. Schematized dredging strategies
B. Growth curve at location Borssele with resulting wave heights after dredging

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