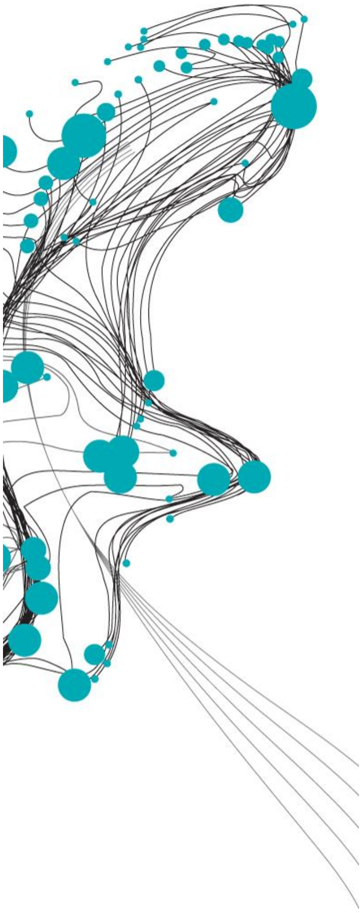
# HYDRODYNAMICS AND SAND TRANSPORT ON THE LOWER SHOREFACE OF THE AMELAND TIDAL INLET



The lower shoreface, part of the coastal profile located between 8 and 20 m water depth, corresponds to the deeper part of the so-called Coastal Foundation. This is defined as the coastal area between the first row of the dunes and 20 m depth contour. It is one of the main concepts for the management of the Dutch coast. In order to provide long-term coastal safety given sea level rise, yearly coastal nourishments are applied. The nourishment volume is determined based on the rate of yearly sea level rise and the area of the Coastal Foundation assuming there is no significant net sediment transport through the offshore boundary. This assumption is not well substantiated and to investigate alternatives for the offshore boundary of the coastal foundation zone and the associated nourishment volume, a new “offline” approach was proposed by Grasmeijer (2018). This approach allows net annual sediment transport at any lower shoreface location to be calculated using currents from the DCSM-FM model (Zijl et al., 2018) and waves from the Wave Transformation Tool (de Fockert et al., 2011).

The objective of this master project was to obtain a better understanding of the hydrodynamics and sand transport on the lower shoreface of the Ameland tidal inlet and to validate the new sand transport modelling approach. To meet these objectives, first, current measurements conducted in November and December of 2017 at 11, 16 and 20 m water depth were analysed in order to assess the effect of storms. The data analysis has shown that during storm events characterised by north-western wind and waves of more than 4 m there is an eastward and onshore residual flow, signs of which are also observed at 20 m water depth. These currents are not captured by the DCSM-FM model which does not include wave-driven currents (Figure 1). This results in a similar mismatch in cross-shore and longshore sediment transport. Comparison with the yearly transport rates calculated with the modelled currents has shown that this mismatch can be significant even at 20 m water depth and, because of that, in its current state the “offline” approach cannot be applied for the analysis of the net annual sediment transport rates on the lower shoreface of the Ameland tidal inlet. Analysis of the contributions of different sediment transport mechanisms has shown that the role of wave asymmetry and near bed wave-induced streaming is negligible. The effect of Stokes drift can be significant, especially for the years that are characterized by large storm events, as well as wind-driven currents, which cause an increased eastward longshore and offshore transport.

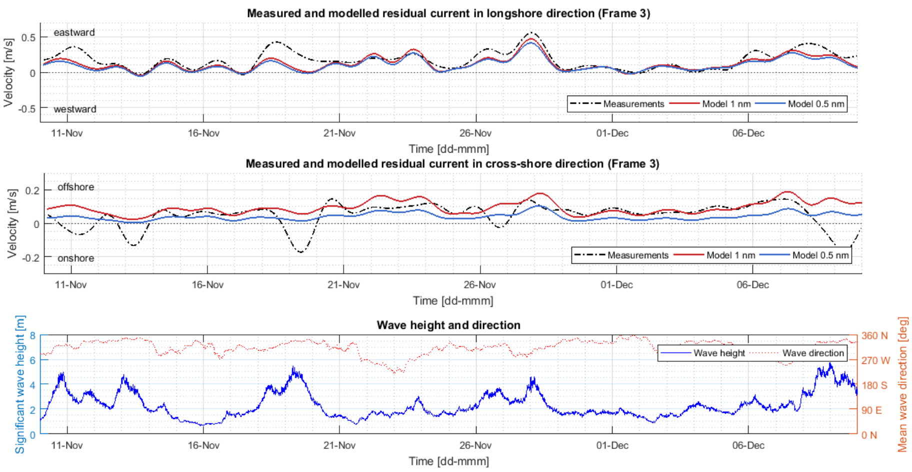



*Figure 1: Longshore and cross-shore measured and modelled depth average residual current at 16 m water depth*

De Fockert A., Luijendijk A. (2011) Wave look-up table: Building with Nature. Memo 1002337-002-ZKS-0001. Deltares, Delft, the Netherlands

Grasmeijer B.T. (2018) Method for calculating sediment transport on the Dutch lower shoreface. Memo 1220339-005-ZKS-0002. Deltares, Delft, the Netherlands

Zijl F., Veenstra J. (2018) Setup and validation of 3D DCSM-FM. Memo 1220339-005-ZKS-0003. Deltares, Delft, The Netherlands

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