

# DATA ANALYSIS OF ESTUARINE DUNES: LINKING ESTUARINE DUNE CHARACTERISTICS TO ENVIRONMENTAL PARAMETERS



In estuaries, dunes are often found. Dunes are rhythmic features that exist on the bed. They can limit navigation depths and alter the flow structure and sediment transport. Large scale studies investigating the dependency of estuarine dune characteristics on the environment have not yet been conducted. Therefore, the goal of the study is to explain the dune length, height and asymmetry based on the water depth, tidal asymmetry, river discharge and sediment grain size. To this extent, bed level and environmental data is available of the Western Scheldt and the Elbe estuary.

The focus in the Western Scheldt is set on the spatial variability of estuarine dunes and environmental parameters by analysing three study sites which are each mapped twice in the period 2017-2019. The Elbe is analysed for temporal correlations using a single study location which is mapped 60 times in the period 2012-2014. The bed level of both estuaries was measured using multibeam echosounders.

Dune characteristics are extracted from the bed level data using a bedform tracking tool. Environmental data is processed in order to obtain the average water depth, river discharge and flow velocity asymmetry, characterising the bed level measurements.

The results of this study show a positive weak correlation between water depth and dune height in the Elbe, and water depth and dune length in the Western Scheldt. Since the dunes in the Elbe and Western Scheldt study locations exist in the same range of water depth, these obtained correlations were not able to explain the differences in dune length and height of the Elbe compared to the dunes of the Western Scheldt. Two study locations in the Western Scheldt showed differences in dune height and length. These dunes also exist in the same water depth range. Additionally, the median grain sizes of these study locations are very similar and can therefore not be used to explain differences in dune characteristics.

The dune asymmetry showed the strongest correlations with the environmental conditions. In the Elbe, the dune asymmetry correlates with the river discharge and velocity asymmetry (figure 1) with an R-squared of 0.60 and 0.73, respectively. In the Scheldt, the dune asymmetry correlates with the velocity asymmetry with an R-squared of 0.86. This interdependency between the velocity asymmetry and the dune asymmetry can possibly be useful information for hydrodynamic modellers but should be further investigated for a more rigid theory.

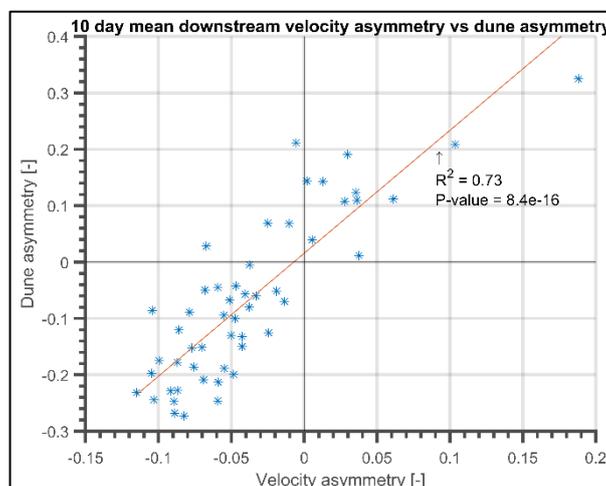


Figure 1: Correlation between the velocity asymmetry and dune asymmetry in the Elbe estuary.

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