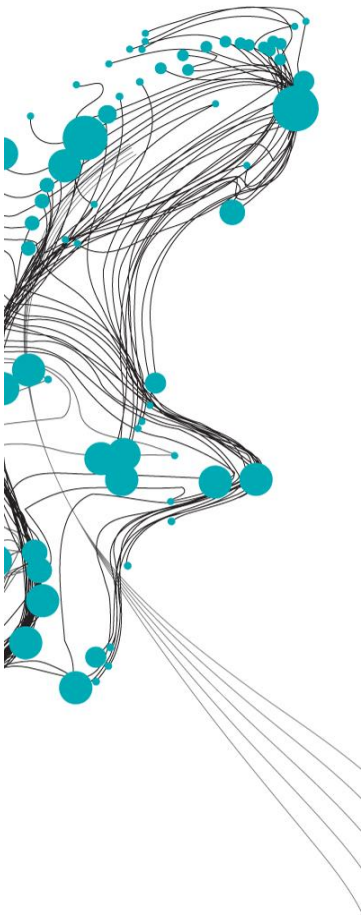
A STATISTICAL APPROACH TOWARDS THE RESPONSE OF DUNE SYSTEMS TO TIDAL INLET PROCESSES



Tidal inlets are complex systems that have an unknown influence on adjacent dune systems. The objective of this research is to assess which tidal inlet processes are important for dune development. A statistical approach, namely categorical regression, is used to assess which processes are significant.

For this research, 45 tidal inlets and its adjacent dune systems were selected from western Europe, the contiguous United States, Brazil, Africa and Australia. These inlets were characterized based on the hydrodynamic forcing, the migratory behaviour and the number of channels, whereas the adjacent dune systems were characterized by the overall dune development, the vegetation cover, the extent of the active part of the dune system, the maximum observed dune height, the climate type and the wind regime.

The data set is analysed using CATREG, an algorithm for regression of categorical variables. This algorithm quantifies the categorical data and then does a linear regression. The output of this model gives which variables are significant for responses in the dune system. The responses were the overall development of the dune system, the extent of the active part, the vegetation cover and the maximum dune height.

The overall development of a dune system near a tidal inlet seems to be affected by the hydrodynamic forcing and the migration of the inlet. Furthermore, the dune height seems to be affected by the climate and the vegetation cover. The vegetation cover itself is affected by the wind, the climate and the migration style of the inlet.

The migration of a tidal inlet is the only accessed inlet-process that significantly influences the nearby dune systems. The other significant processes, such as the hydrodynamics and wind, are also present near straight coasts. However, the morphology, topography and geometry near the tidal inlet may influence the local hydrodynamics and wind conditions, so the exact influence of those processes may be different than on straight coasts.

As a conclusion, the migration of inlets is the most direct factor leading to dune systems behaving differently near tidal inlet than on straight coasts. Other processes, such as waves, are also present near straight coasts, but they may be influenced by the morphology of the tidal inlet. Although the statistical test has large uncertainties involved (e.g. high unexplained variability), this research gives some insight in the important processes in an around dune systems near tidal inlets.

Figure 1: Aerial photograph of Murray Mouth, Australia. The black lines show the seaward boundary of the dune system in 2003 and 2017. The expansion at both sides of the inlet can be clearly seen.

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