

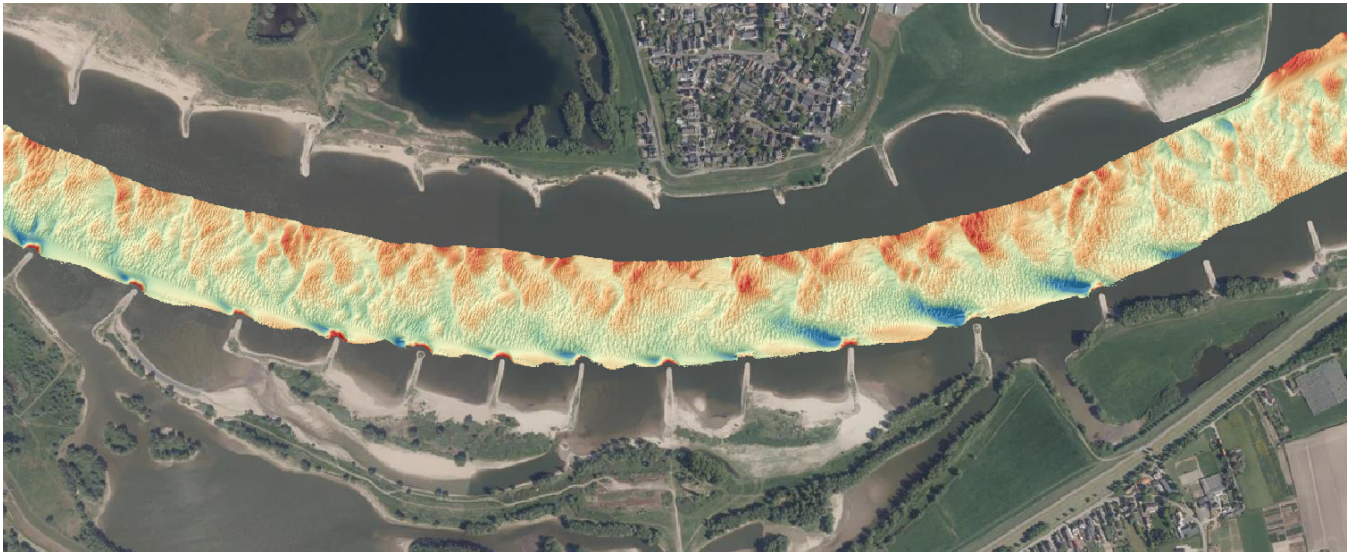
DEL107 - Dune Dynamics and Preservation in the River Waal, using MBESPES

Introduction

River dunes occur in low-land rivers worldwide and are vital in estimating sediment transport and deposition within fluvial systems. Dune sizes and mobility vary and therewith may interfere with inland shipping and affect sediment (bedload) fluxes. Analysing bed morphodynamics allows for determining spatio-temporal variations in size and migration rate of individual dunes, as well as the long-term, large-scaled trends in bed elevation. However, merely dune tracking does not fully explain sediment storage/reactivation in river systems. Observing sedimentary structures in the shallow subsurface will enable us to reconstruct the preservation and reactivation of river dunes over time.

This project aims to collect high-resolution Parametric Echo Sounder (PES) data of the subsurface of dunes in the River Waal, Netherlands, simultaneously with multibeam data and sediment vibrocores, and to interpret internal dune structures, to - in a later phase - be able to couple these structures to morphodynamics as obtained from multibeam (MBES) time series.

The project will result in knowledge of river systems and new technical know-how on applying the PES technique in Dutch rivers. This knowledge can be used for quantifying sediment dynamics for river management, improving numerical models with bed roughness and sediment supply predictors and for improving shipping safety.



^ River dunes in the Waal. A deep understanding of the dynamics of these structures is of paramount importance for estimating sediment transport and deposition within fluvial systems

Phase 1 - Gathering field data and preliminary analyses (2021-2022)

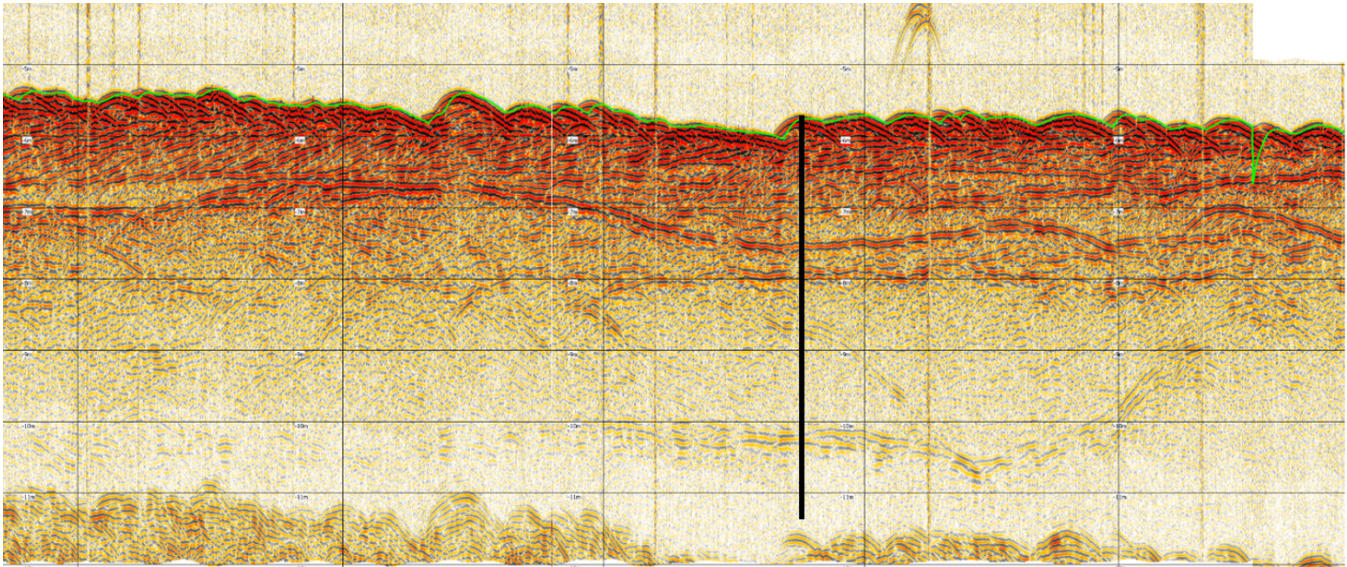
Multibeam and PES data were acquired at three sites of contrasting grain sizes in the River Waal. Site 1 is located furthest downstream near Ophemert and site 3 is furthest upstream, near the town of Druten. At each of these sites timeseries were recorded along four longitudinal tracks of about 7 km in length and spanning the width of the navigation channel.

The following datasets were acquired for each of the three sites:

- High-resolution depth and backscatter datasets, acquired using the MBES system onboard the survey vessel of Van den Herik Kust- en Oeverwerken BV, Sliedrecht,
- High-resolution PES datasets, acquired by Van den Herik, using a PES system rented from Innomar Technologie GmbH, and
- 18 Vibrocores, collected by Marine Sampling Holland (MSH) onboard the MS Europa, a work vessel from the Dive and Salvage company Europa.

The MBES/PES data were collected simultaneously and surveys were designed to be conducted in time series, taking into account the dune migration rate. The first survey was carried out between the 31st of May and the 4th of June 2021, including a repeat survey at Site 1 after four days. The second full repeat survey at the three sites was carried out three weeks later, between the 21st and 25th of June, with the addition of acquiring the vibrocores. The locations of these vibrocores were based on an analysis of the first PES dataset, adjusted by inspection of the second PES survey (on the same day) and were chosen to include well-distinguishable structures, such as dune foresets and erosion surfaces.

Initial analyses of the data are being carried out by Deltares and the University of Illinois at Urbana Champaign (UIUC), USA.



^ Example of PES results and vibrocore location. Multiple erosion surfaces and dune structures can be distinguished.

Project partners

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Subcontractors

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Dive- and Salvage company Europa, Netherlands

Phase 2 - Further analysis of the data: coupling to morphodynamics and sediment characteristics (2022-2023, to be acquired)

An anticipated follow-up "phase 2" of the project will be focusing on linking the results of phase 1 to morphodynamics and sediment characteristics. The following tasks will be planned:

- Describing the vibrocores, taking lacquer peels and subsamples,
- Quantified analyses of bed morphodynamics between the first and second MBES survey of this project and a longer-term, two-weekly MBES time series.
- Coupling of these analyses to the analysed PES data and sediment characteristics determined from the vibrocores.