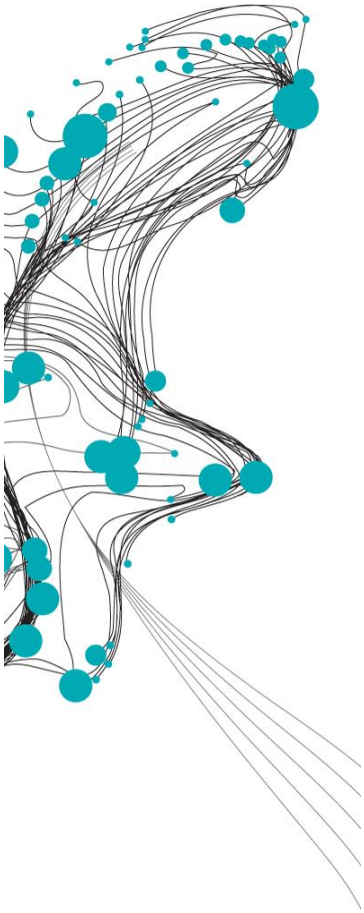
The applicability of the ASED-sensor for measuring bed level changes in intertidal areas



The ASED (Acoustic Sediment Elevation Dynamics)-sensor is a stand-alone measuring device designed by NIOZ, to study bed level dynamics within intertidal areas. The ASED-sensor was used to study the morphological behaviour of intertidal flats. However, the sensor was not yet properly tested, and lacked an algorithm and autonomous script for translating raw intensity data into bed level data. Therefore, the objective of this study is to assess the applicability of the ASED-sensor for measuring bed level changes in intertidal areas. It includes developing the raw data processing algorithms and their implementation in Python scripts.

The ASED-sensor uses a pulsed acoustic signal of approximately 300 kHz to measure bed levels during submerged conditions. The reflected signal by the bed is detected by a sudden increase in amplitude (first reflection; Figure 1). The travel time of the signal from the sensor to the bed and vice versa needs to be converted to a distance, to obtain bed levels. The sensor will be tested both in the lab and in the field. The lab experiments are tested in a range of environmental conditions consisted of water depths, soil types, dilutions of soil types, and waves and current forcing. The field experiments were performed in the Eastern Scheldt, next to NIOZ, and in the Western Scheldt at the Kapellebank (Figure 2).

At the start of the study, the ASED-sensor lacked an autonomous script for translating raw intensity data into bed level data. The Kalman filter method showed the most promising results, with the lowest standard deviation and lowest computation time.

The practical measurement domain for the ASED-sensor is from 0.20 m to 0.45 m, according to the raw data analysis of all lab experiments. The coefficient of determination (R^2) between the newly developed script and the manual measurements was 0.99 for the lab experiments. The bed could be detected during the field experiments. The actual accuracy is 2 mm to 4 mm, obtained from the lab experiments. The ASED-sensor, with its high vertical accuracy, low labour-intensive deployment cost and reasonable cost, is well suited for monitoring bed level dynamics in intertidal areas.

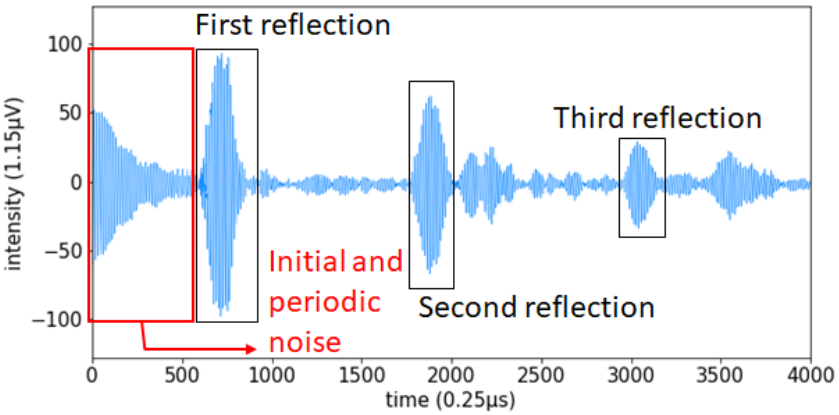


Figure 1: Raw data of the ASED-sensor during lab experiments

Figure 2: Set-up of the ASED-sensor during the Western Scheldt experiment

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