ESTIMATING ALONGSHORE SEDIMENT TRANSPORT FROM DREDGED ACCESS CHANNELS

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INTRODUCTION

Alongshore sediment transport rates are important in sediment budget studies or design of coastal structures. Underestimated transport rates give rise to severe siltation updrift from cross-shore structures and severe erosion downdrift. Overestimates may lead to over-design and thus high costs. Currently, these estimates are generally obtained from sediment transport equations, morphodynamic numerical modelling or bathymetrical changes in accumulation areas (Vandebroek et al. 2017). However, alongshore transport is difficult to estimate from regular bathymetrical surveys, since only locations with gradients in the transport will provide information via volume changes. On a straight coastline the sediment will simply pass by.

Here an alternative data-based approach is proposed, studying an access channel suffering from repeated siltation. The recreational port of Blankenberge, Belgium, is connected to open sea via a short access channel. It is only separated from the beach trough two smooth low-crested breakwaters, and two open pile structures (“staketsels”). Sediment is easily transported over the breakwaters during mid to high-tide, silting up the access channel. Bypassing around the breakwaters also takes place (Teurlincx et al. 2009).

As the access channel effectively serves as a sediment trap it can be used to study alongshore sediment transport rates. The access channel is frequently dredged and even more frequently surveyed. It is therefore suitable to make estimates of sediment transport on the time-scale of weeks to months.

METHODS

More than 90 multibeam bathymetric surveys are available for the years 2016-2020, covering the access channel to the recreational port of Blankenberge at 1m grid resolution. Volumes are derived in three distinct sedimentation zones to each side of the channel and in front of the entrance, all of which show particularly high bed-level variability. Timeseries of volume change are derived for each of these zones. Surveys are inspected for dredging activities in the zones and the volumes corrected as necessary. Instead of using reported dredging volumes, bathymetric differences are taken from a dredged to a siltated state.

RESULTS

Over the course of a week (6-14 February 2020), during the passage of storm Ciara, $12*10^3$ m^3 of sand was deposited inside the access channel, which is similar to the entire month (7 January to 6 February) before. A period of calmer conditions (16 December 2019 to 7 January 2020) resulted in only $2.5*10^3$ m^3 of siltation. These volumes could be scaled to annual transport rates of $5.5*10^5$, $1.5*10^5$ and $0.4*10^5$ m^3/year respectively in North East direction. Bypassed volumes were not yet included.

Annual alongshore sediment transport rates show large variability, ranging from $1.2*10^5$ to $2.3*10^5$ m^3/year, which is in agreement with e.g. Vandebroek et al. (2017).

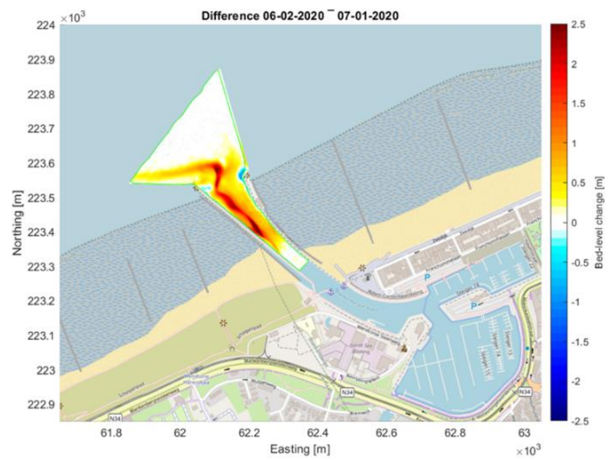

Figure 1 – Blankenberge access channel, siltation during one month of winter conditions. Colours indicate accretion (reds) and erosion (blues).

CONCLUSIONS

Estimates of weekly to annual alongshore sediment transport rates are derived from frequent bathymetric surveys in a continuously siltating access channel along the Belgian coast.

Uncertainties in dredging levels and volumes are eliminated by investigating only the difference after dredging.

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