Deriving alongshore sediment transport from dredged harbour channels : Case-study of Blankenberge

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Wind and waves continuously move sediments along sandy coasts. The amount of sediment transport is an important parameter in the design of ports, coastal structures and coastal protection measures. Sand may accumulate next to a breakwater or erode from a beach replenishment, the amount of which depends on (gradients in) the sediment transport rate. However, it has proven difficult to make an accurate assessment of the sediment transport rate (Vandebroek *et al.* 2017). Simple analytical equations are inaccurate, while numerical models require large computational effort.

Here a data-based approach is proposed for sediment transport along the coast, using repeated surveys of the sea bed in harbour channels. The harbour of Blankenberge is studied as an example. It is connected to the North Sea via a short channel through the beach. This channel is separated from the beach by two very low breakwaters and open pile structures ("staketsels"). Sand is easily transported over and around the breakwaters due to waves and strong winds, accumulating in the channel (Teurlinckx *et al.* 2009). As the channel serves as an effective sediment trap, the sediment transport rate can be derived. Frequent bed-level surveys are carried out for the required dredging operations to keep the harbour sufficiently deep (Afdeling Kust, 2021). This makes Blankenberge a suitable location to determine the sediment transport along the Belgian coast on a weekly to monthly time scale.

It turns out that the amount of sediment deposited in the channel during several days of storm ($32*10^3$ m³, 6-14 February 2020) can be more than an entire winter month without storms ($23*10^3$ m³, 7 January – 6 February 2020). During calm periods, usually in summer, this reduces strongly (ca. $3*10^3$ m³/month). The average yearly transport between 2015 and 2020 in Blankenberge is $145*10^3$ m³, which is in agreement with Vandebroek *et al.* (2017). Moreover, the distribution of sediment transport over the beach profile can be determined. For now this is still limited to three zones: dry beach, intertidal beach and permanently submerged. These zones, on average, account for 4, 34 and 62% of the total transport respectively. Thus, wind driven (or aeolian) transport contributes for a small, yet significant proportion to the alongshore sediment transport. This wind driven component is in agreement with calculations by Strypsteen *et al.* (2019).

References

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Keywords
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