Dear authors,

I have read your manuscript with great interest. There is no doubt that this unique data set needs to be published (16! ADCPs over a period of 6 months, including a storm season). I am however not sure whether the chosen format is the best. You might consider changing the manuscript to a hydrodynamics-only paper. Leaving out the somewhat artificial way of dealing with sediment transport (a power of the velocity and neglecting waves) gives some more room for detailed analyses of the hydrodynamics. As indicated below, my main suggestions are related to the discussion part (the mass balances for cross shore and longshore). I hope these suggestions help in improving the paper.

Best regards,

Bram van Prooijen

Introduction

Line 44-54: The flow and sediment transport on mid-channel bars is described. It is suggested in L53-54 that the flow over the flats (differences with fringing flats) will likely have an effect. This has been studied already in De Vet et al (2018), where such flows (especially during wind events) occur and where it is shown that the combination of wind and waves are crucial for sediment transport. See also the work by Elmilady et al. (e.g. 2021).

Line 55: this line needs some nuance, as there is quite some quantification by numerical modelling, but field measurements are indeed not so abundant.

Overall, the literature review could be a bit broader, like including the work of the groups from San Pablo Bay (Lacey), the Seine and other French estuaries (Grasso, Verney, le Hir), the German systems, Chinese systems like the Yangtze Estuary or Jiangsu coast, the Danish Wadden Sea? Not all need to be included, but some would embed the paper better in literature.

Methods

Field site: this section contains a lot of Dutch names that are not further used in the Results or Discussion section. You could simplify it and refer to various other papers which elaborate on the history of the Western Scheldt and tidal flats. For example references would be needed to back up the last sentence “This rapid elevation decreases the intertidal area and increases the percentage of silt in the bed.”.

Data Gathering: This is the strong point of the paper. The set up with so many ADCPs is unique. This might be emphasized a bit more here, but also in the abstract.

Data Filtering: L131-132: It is not fully clear for me why the data at VLIS and TERN were needed, as the ADCPs also record water levels. L133: what does manually checked mean, what was done, what were criteria?

Sediment Transport: The approach to determine sediment transport is fully based on the flow; waves are not considered. This should at least be mentioned here and later on in the discussion. Waves will likely have a substantial effect on sediment transport. Why is chosen for a formulation without a critical shear stress?

Results

Large scale flow patterns: L175-185 The peak flow around 50-60 min before high tide is likely a peak in longshore velocity. The peaks at 14 and 24 will likely have a cross-shore component too. This could be more emphasized here or in the discussion on the flow bending around the higher area in the west. The description in this part is somewhat unsatisfying, as it is not fully clear why these phase shift are given. Are they to be discussed in the discussion? L192-197: The spring tide ebb peak in 31 and 41 is (much) more pronounced and this peak also seems to be present in 11, 12 and 32 for spring tide. This might be related to a dewatering process that is stronger during spring tides. Most spring tide flood peaks seems to be a bit later than the normal tide flood peaks.

Sediment transport: L218 indicates a modulation by the spring-neap tidal cycle. This might be phrased stronger: sediment transport occurs during spring tide and almost nothing happens during neap tides. Only at 12, the alongshore component shows some changes during neap. The effect of the episodic event is indicated. This effect will in reality be much more important as waves will play a role in eroding the bed. This is relevant to note here.

L223: “At all transects the cumulative sediment transport near the bed is smaller than the depth-averaged transport in along-shore as well as cross-shore direction.” This is a direct consequence of the smaller velocity near bed than depth-averaged. You could consider to

plot only the transport based on the near bed velocity, as you consider bed load. Having said that: the velocities are quite high, so suspended load might be important here. Did you check Rouse numbers?

Section 4.1

A 1D model is proposed, based on the rigid-lid approach and the subsequent volume balance. Such a model assumes that the width is uniform and that the flow is purely in one direction. A hard boundary condition was imposed at the highest point in the profile, assuming that flow cannot flow over the highest point (i.e. there is no net flow over the bar.

To compare the model results with the measurements, a linear regression is proposed (L270). It confuses me a bit why such an approach is chosen, as the model is based on a volume balance, there is no calibration parameter or so. What does the values for a and b thereby mean? You could consider to plot the results and indicate that they are all below the 1:1 line. This suggests that (i) the assumed control volume (no uniform width); (ii) or the boundary condition (no flow at the highest point); or (iii) the assumption of no longshore gradients; or (iv) the assumption of a uniform water level (no friction) does not hold (a better definition of these four might be needed). By only presenting the values for a and b, it is not clear during which parts of the tide the model is performing well and when not (is there a difference between neap or spring, or between ebb or flood?). Flow over the highest point would only be of importance during emergence of that highest point. The potential causes (i-iv) could/should be unravelled in more detail. Based on the present results, it is not clear which cause is most important. It is therefore also unclear what the cross shore current drives.

For example, the assumptions of a 1D model are quite violated for Transect 1. There is net cross shore flow velocity and likely also discharge? (Figure 6); there is likely a longshore gradient in longshore velocity; friction will likely play a role during dewatering. The values for a for Transect 1 are therefore much smaller than 1.

This section needs to be reconsidered.

Small notes:

L263: why was smoothing with a 100m window needed?

L276: the model does not need a bed level with a constant slope (linearly changing bed level). The model can cope with a convex-up slope.

L276: contraction -> contradiction?

Line 279: the model assumes that the longshore flow is uniform, not zero, see also L278.

Section 4.2

To explore the causes for the longshore current, another volume balance is considered. In this case, the balance is fully based on measured velocities and depths. If the aim is to explore the causes for the longshore velocities, I would rather use a momentum balance. In this way, the contributions of pressure gradients, bed friction, wind stress, advection, etc could be quantified. The volume balance is now only presented for a single area and only for two tidal cycles. In L305 it is even mentioned that the method does not work for the other areas. It would be valuable to explore whether there are differences in dominating terms between spring tides and neap tides. I would also expect that wind events would have a different balance between the different terms. Furthermore, it would be interesting to compare the difference between lower and higher area for the balance between the various terms: is friction more important on the higher parts?

In its present form (volume balance), it is unclear what drives the along-shore flow. A reconsideration would be needed for this section too.

Section 4.3

The title is "*Large-scale sediment transport patterns on mid-channel bars and their dependence on external forcing and morphology*". It suggests a dependence on external forcing. The sediment transport is however based on the local velocity, which is not an external forcing. Two aspects are considered (L310-313): effects of wind and effects of local morphology. An aspect that I miss is the effect of the neap-spring tidal cycle. It is mentioned a bit in the Results section. In the analysis on the effect of the wind, it is not clear whether the effect is caused by the surge or by the local wind stress. As indicated earlier, the waves will have a crucial role here too.

L316-320: the data set is split into two parts, based on wind speed. It is not clear which periods are in which category, nor why the Bf3 and Bf6 are chosen. Are there periods with wind >6Bf but from another direction than from the west? It would be helpful to indicate the bands of mild conditions and storm conditions in Figure 7. It would then become clearer whether wind affects the flow (sediment transport).

Figure 12 and associated text is very difficult to follow and interpret.

The ebb dominance of the channel between the main bar and the spit could get some more elaboration. The explanation in L330 is a bit short. Can you explain more about the dewatering of the shoal via that channel?

Figure 2 shows a clear difference in bedform patterns. Are these differences to be considered too?

Conclusions

343-350: The assumption is made that it is commonly assumed that cross-shore velocities are the only driver for filling/emptying a tidal flat. This is maybe somewhat overstated. Other authors (e.g. de Vet et al) also indicated already the more complex flow patterns on shoals.

L344: It is not convincingly shown that 2DH models overestimate bed load transport. The argument given in the next sentence mention a representative time period. These seem two different aspects: (i) is a 2DH model able to represent the flow?; (ii) can a representative period be used for upscaling? A statement about the validity of numerical models would need more elaboration.

The impact of waves is not considered in this study. It should at least be mentioned somewhere. How would the wave impact change the conclusions?

L370: this is a bit demotivating for almost all readers, especially as last sentence. Even 16 ADCPs are not enough to identify the main flow patterns? Most readers will likely have much less instruments. It would be valuable to indicate what would be possible with less instruments. Would you place them in a transect or in a cross?