General

The paper is well written and is almost ready for publication.

Nevertheless the authors conclude that even this intensive measurement campaign is to short and the resolution is too low to fully understand the complex flow patterns and sediment transport, still he dataset is valuable for publication.

There are a few general remarks I would advise to elaborate or to comment on in more details to improve the manuscripts:

- In the introduction the authors state appropriately that one of the main forcings for the sediment transport at intertidal flats is the (ship induced) wave exposure. Wave exposure was not measured or modelled for the field side. Nevertheless, during the six month measurement campaign a 3 week period of stormy condition occurred. The field side is close to the estuary mouth area and the main shipping lane towards the seaports of the Scheldt Estuary. Therefore, the authors should elaborate a bit more on the expected wave impacts at the field side and their consideration for not measuring, or modelling wave exposure at the field side.

  Reply: We agree that waves may be important in relation to the sediment transport patterns, if high magnitude waves occur often enough to modify the current-driven morphodynamics. However, we don't have enough spatial information to quantify the effect of waves in detail and we therefore decided to focus in this manuscript solely on the role of currents. To gain better insight into the effect of waves especially during storm conditions and higher up the intertidal bar, the effect of waves will be addressed in a follow up study using a high-resolution numerical model that will also include the effect of waves. The effect of waves induced by vessels is, due to the distance of the navigations channel and the shallow bar 'Spijkerplaat' located between the channel and the field site , is assumed to be very small.

  We suggest the following change to the Introduction (L64-69)-:

  For this, we analysed the measured the current velocities on a spatial grid at 16 locations for a period of 6 months on a mid-channel tidal bar in the Western Scheldt estuary in the Netherlands. The results are compared to simple models developed for open and fringing flats, which serve as a starting point for understanding differences with mid-channel bars. The measured cross-shore and alongshore velocities were used as input into a simple sediment transport predictor to understand how the hydrodynamic forcing and tidal flat morphology determine the sediment balance of a mid-channel tidal bar. The effect of waves on the sediment transport, as described in among others (Roberts 1999, LeHir 2000, Green 2013, Hunt 2015, Maan 2015, Hunt 2016, de Vet 2108) was omitted in this study since spatial information to quantify the effect of waves on sediment transport was missing.

- A very simple sediment transport approximation is used (alpha x u^3). To my opinion, this could be extended to some extra transport formula like Engelund-Hansen or Van Rijn formula which are commonly used in numerical models. Rather than comparing bed load to depth averaged transport in de simplified approach, which is in my opinion incorrect (see comments below), I would advise to compare the different models for total load. Transport calculations are only based on velocity measurements. A sediment concentration measurement (maybe for a short time and limited number of locations) would have be an added value to validate the approach. The authors can comment on that in the conclusions.

  Reply: Our interest is to gain insight into the large scale patterns and the forcings that steer the sediment transport and the spatial gradients thereof, which drive morphological change. Therefore a simple proxy was used, based on the measured current velocity. The use of different predictors will have no great impact on the qualitative patterns found, since these also rely on the current velocity in a nonlinear way. An Engelund-Hansen predictor will have a dependency on flow velocity to the power five while we used a power of three. This will change magnitudes, not patterns. Sediment concentrations were not measured during the campaign. In the conclusion section (L365-366) it is recommended to attempt measuring suspended sediment transport in future campaigns.

- The authors highlight and show the importance of wind on the sediment transport by comparing a period with strong wind conditions to a calm period. However, from the manuscript it is not clear which is the most important driving mechanism: is it the local wind shear stress causing extra wind induced currents in the channel and shallow intertidal area, or is it a more global effect of SW to NW winds and atmospheric pressure fields associated with these that cause extra surge during rough and stormy conditions leading to higher high waters and/or tidal range and thus longer submerging time of the tidal flats? From a modelling perspective, it would be very valuable to go more in depth on this, merely since the authors highlight the sensitivity of 2DH models to external forcings.

  Reply: see our reply on remark Line 320-325

Minor remarks on the text:

- Line 26: For sediment transport patters not only direction of the tidal flow and wave exposure are important, also strength of the tidal flow, tidal range, grain sizes and sand-silt ratio.

Reply: This will be added to the text in the revised manuscript.

- Line 56: For many estuaries 3D models are developed as well. When only investigating currents and sediment transport, computational cost is not that much an issue anymore. Unless for long term morphological simulations. However, often these 3D model tend to perform poorly in very shallow areas like on tidal flats. Another technical issue is wetting and drying which still remains a technical challenge from a numerical point of view.

  Reply: We agree on the fact that 3D models are available for different estuaries and that there are still issues on their performance.

- Line 87: The Western part of the Scheldt Estuary is very dynamic, specially the Schaar van Spijkerplaat. How stable is the channel where the measurement (points 1) took place?

  Reply: The channel was not stable during the measurement period: sedimentation occurred as is shown in Figure 1 of this reply. As is described in Lines 111-112 of the paper, the sedimentation did affect the measurements at location MP4.

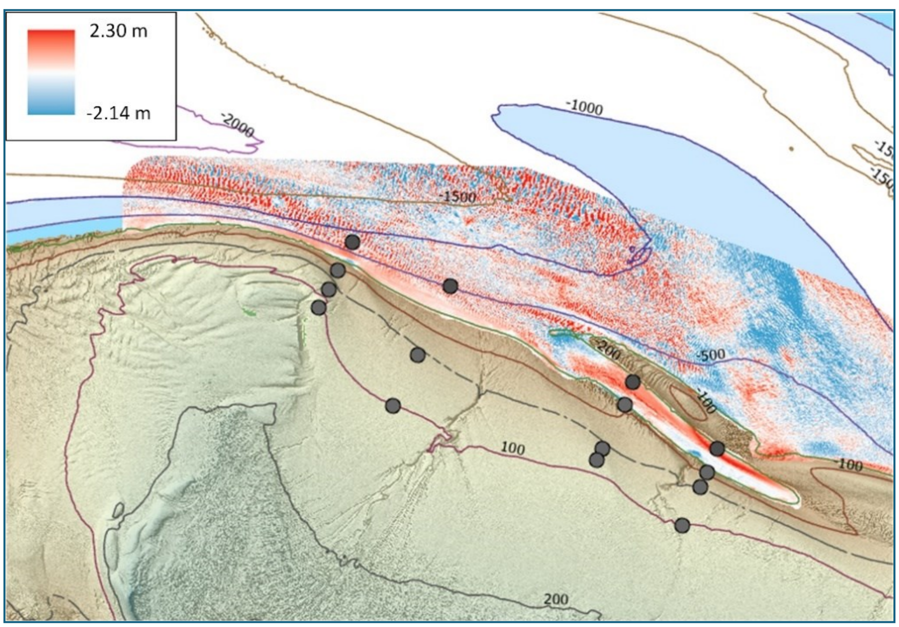

Figure 1 Difference in meter between the surveys from 24-06-2019 and 28-02-2019. Red is sedimentation, blue is erosion.

- Line 99: How is rapid bed elevation increasing the percentage of silt in the bed

  Reply: We suggest the following change to the text:

  L99: Peak flow velocities decrease as the bed level becomes higher. As a result, finer sediments will settle easier, thereby increasing the percentage of silt in these areas.

- Line 139: what was the threshold

  Reply: We suggest the following change to the text (L139-140):

  Second, classes with a number of samples less than a predefined threshold were removed. This threshold was visually determined for each location, since this value depends on the number of representative samples per timestep in the dataset. Third, within a moving window of 30 minutes, the 50\% and 95\% values of the current magnitude and the circular mean (Fisher1993) of the current direction were calculated.

- Line 152: in the equation: ms^{-1} is the unit, place between brackets.

  Reply: All units in the text are without brackets as instructed in the journal format.

- Line 167: During the stormy periods, what wave heights are estimated at the measurement site? Was it measured, a wave model could give some insights?

  Reply: see our reply to the general remarks.

- Line 172: Why are the peak ebb and flood currents averaged over the full measurement period? Peak currents can be significantly different between neap and springtide.

  Reply: Our interest is the general sediment transport pattern and the differences in the vertical profile. Therefore the averaged peak flood and ebb velocities over the full measurement periods of the lowest cell, the top cell, and the calculated depth averaged are used.

- Line 183: Ebb currents at 31 and 41 differ indeed from what one would expect like in 11 and 21. Is there an explanation for? The gully looks like a floodgully.

Reply: the ebb dominant character of these two locations could possibly be explained by dewatering of the shoal and the flow coming from the ebb dominant part of the channel 'Schaar van Spijkerplaat'. The last one contributes to the current flow at these locations as long as the northern sand spit is submerged.

- Line 225: Since the transport is only calculated based on the measured currents without taking the concentrations into account, this conclusion is in my opinion presumptuous. Generally the formulation u^3 holds only for the total load with u the depth averaged velocity. I don't think it makes sense to differentiate between total load and bed load.

  Reply: we use the proxy to gain insight into the possible effect of subtle differences in the velocity profile on sediment transport magnitude and direction. We are aware that we need the vertical sediment concentration profile as well to quantify the full effect of the change in flow velocity direction, but we don't have these available. However, we are convinced that our approach shows the same effects. Typically, sediment concentrations are much larger near the bed than higher up in the water column. The sediment transport direction is therefore largely influenced by the direction of the near-bed flow velocities. This is the reason why we chose to compare sediment transport directions between a u^3 calculated with depth-averaged and near-bed velocities. Hence, this proxy offers a quick scan of the impact of the current velocity at different depths to the sediment transport direction.

- Line 320-325: Needs some more clarification and motivation on why and how DS2 is compared to the linear regression of DS1. At least for some of the station: make a scatterplot with the linear regression and DS2 peak velocities. From the text it is not clear how the wind is influencing the peak velocities: is it a direct effect of the wind shear stress. Or is it due to the fact that SW tot NW winds cause a higher surge which lead to higher tidal amplitude?

  Reply: We suggest the following change to the text:

  L316-324: To quantify the effect of wind on the peak velocities we compared the peak current velocities during situations with almost no wind (wind speed less than 3 Beaufort) with those occurring during periods with high wind speed (more than 6 Beaufort). To do so, we proceeded with the following steps. First, we divided the dataset containing peak velocities into two subsets: dataset one (DS1) containing peak velocities during wind speeds smaller than 3.3 ms^{-1} (3 Beaufort), and dataset two (DS2) containing peak velocities with wind speeds larger than 10.8 ms^{-1} (6

Beaufort). For both datasets the tidal range associated with the peak velocity was also registered. Second, for each measurement location a linear fit was made between the tidal range (X) and the peak velocities for ebb as well as flood (Y). Third, the obtained regression coefficients were used to calculate the peak velocities of DS2 given the tidal range in the dataset. Finally, to determine the effect of higher wind speed represented in DS2, the fraction between measured and calculated peak velocities was calculated. These are shown for flood and ebb with a logarithmic scale in Figure 12. We see the most pronounced effect on the current flow at the shallowest parts of the tidal flats, especially during flood. This strong increase of flow velocities throughout flood high up the tidal flat also explains the more episodic character of the proxy for sediment transport at the highest parts of the tidal flat. During ebb when wind and tide are in the opposite direction, there is a reduction of the peak flow, although at the most shallow locations the current flow is amplified, despite the ebb current. The mean tidal range for both periods is almost the same: 3.72 m and 3.68 m for DS1, resp. DS2. Therefore changes in the peak velocities will be mainly caused by the wind stress.

To clarify Figure 12 we propose to change the caption to:

The effect of wind on the current peak velocity for flood and ebb calculated as $\log_{10}\left(\frac{U\_\{measured\}}{U\_\{calculated\}}\right)$, with $u_{measured}$ are the measured peak velocities at wind speeds above 8 Bft, and $u_{modelled}$ are the peak velocities calculated with the coefficients derived from the situations with wind speeds smaller than 3 Bft.

- Line 350: see comment before on line 225

  Reply: See our reply to the comment on line 225.

- Line 354: I don't follow this reasoning: Why should a 2DH model overestimating the bed load transport when wind and local morphology are with sufficiently care taken into account in the model? Therefore also the question before: is the wind playing a direct role, or is it the tide affected by the wind at the north sea? This makes a difference in how carefully local windspeed should be incorporated into the 2DH or 3D model.

  Reply: We suggest to change the text as follows:

  L354: We used a proxy to estimate the sediment transport. Based on this proxy we observed differences in the direction and the magnitude between values nearest to the bed, i.e. the lowest measurement cell, and the depth-averaged value. 2DH models adjusted to depth averaged velocities will calculate the correct magnitude of the flow, but deviate from the actual direction. In situations when the direction of the flow in the vertical is not uniform, the calculated sediment transport on 2dH models can have the transport direction wrong. In those cases more sophisticated models are needed if one is interested in bed load transport patterns.

As is stated in the remark on L316-324 wind stress has an effect, especially on the higher elevated parts of the bar. However, external surges originated by external wind fields will contribute to changes in the peak velocities. Therefore, external wind (surge) as local wind (wind stress) is necessary for 2D as well as 3D models.

- Line 365: Sediment disposal is well documented for Western Scheldt.

  Reply: this is a general recommendation. For the Western Scheldt these locations are well known, however for other estuaries this data may be lacking or kept confidential.

- Fig. 1a: please comment on how the arrows are calculated or refer to the source.

  Reply: We will add the following text to the description of the figure: 'Patterns are derived from the calculations with the Scalwest model with a representative spring tide as boundary condition and the bathymetry of the year in question. Ebb or flood dominance is then obtained by determining the maximum depth averaged velocity in each cell.'

- Fig. 4: suggestion to ad a tidal curve of the waterlevels in the channel as well.

  Reply: Thank you. To avoid overcrowding the figure, we indicate the time of HW in each figure.

- Fig. 7: caption in the figure is hard to read.

  Reply: We will clarify it in the revised manuscript.