Rebuttal letter review RC1
Title: Field measurements of hydrodynamics and sediment transport at intertidal areas in the Dutch Wadden Sea
Author(s): Roy van Weerdenburg et al.
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Dear Giovanni Scardino,

Thank you for taking the time to review our manuscript, and for your constructive comments and useful suggestions. We address your comments below. Original reviewer comments are shown in black, while our responses are in *italicized blue*. Text excerpts from the revised version of the manuscript are included in *italicized red*.

Thanks again for your helpful review. Best regards, Roy van Weerdenburg

RC1 comments and suggestions

General comments:

1. Scope of the Dataset: The paper does a great job describing the what and how. For a data paper, it would also be beneficial to very briefly touch upon the so what in the conclusions. While you provide illustrative examples in Section 6, the concluding remarks (Section 7) are quite general. A sentence or two speculating on the specific new insights this combined dataset might unlock (e.g., quantifying the relative importance of wind vs. tide-driven transport over the divide, or validating numerical models of channel-shoal exchange) would be a powerful way to end the paper and encourage others to use the data.

As we addressed in our first response to the reviewer on the ESSD interactive discussion platform, we have been wondering ourselves as well to what extent we should include new insights from the dataset already in this manuscript. Eventually, and after consultation with the topic editor, we have decided to focus the manuscript on the dataset and its reuse by others, rather than on the new insights for the specific topics that we are studying ourselves.

In Section 7 (Summary and outlook) of the revised manuscript, we have elaborated on the specific conditions that are captured in the two field campaigns, and what kind of insights (results) may be derived from analysis of the data.
Regarding the Winter 2023-24 campaign: The strong wind forcing during this measurement period allows for a quantitative analysis of the relative importance of wind- and tide-driven flow and transport.
Regarding the Spring 2025 campaign: Weather conditions during this measurement period were relatively calm, resulting in net accretion at intertidal mudflat locations and predominantly tide-driven transport.

2. Clarity of Objectives: The two primary objectives (basin-basin exchange and channel-shoal exchange) are stated clearly. However, the transition between the two campaigns and how they jointly address these objectives could be slightly sharper. For instance, a brief synthesis statement at the end of Section 3.3, explaining how the Spring 2025 campaign complements the Winter 2023-24 campaign (e.g., "While the Winter campaign focused on the spatial variability across the divide, the Spring campaign added a detailed cross-shore transect within a basin to investigate vertical and lateral exchange processes"), would be very helpful for the reader.

The primary objectives of the two campaigns are the same, although the focus on channel-shoal exchange was added to the focus on basin-basin exchange in the first campaign. We address this in the second paragraph of Section 3.1:

...
The Winter 2023-24 campaign (A stations in Figure 1) was primarily done to better understand the spatial variability in flow and sediment transport between two basins, hence we selected the measurement locations around the tidal divide and located in both the west- and eastward basin. The Spring 2025 campaign (B stations in Figure 1) was done to further improve our understanding of the exchange between basins, but also to better understand the (fine-)sediment exchange processes between channel and shoals in the south of the tidal basin.
...

An important reason for carrying out two campaigns was the variability in forcing conditions in different seasons. We address this as consideration in the design of the field campaigns in the third paragraph of Section 3.1. We address the variability that we eventually captured in the dataset in Section 3.2 and 3.3, and in Section 6.1 (Potential applications). In Section 7 (Summary and outlook) of the revised manuscript, we have now included an explicit statement about the most important aspects of the two campaigns, to highlight the differences between the two.

Specific comments:

1. L12-14: These sentence are too generic, the main outcomes in terms of channel-shoal sediment exchange mechanisms should be reported. How the sediments are distributed along the nearshore and in the channels, and which the main driven-mechanism?

We understand the reviewer's curiosity to see the conclusions from our analysis of the dataset. However, as discussed under General comment 1, we have decided to focus the manuscript on the dataset rather than on the new insights. We have therefore kept the generic discussion of potential applications in the abstract, although the wording has changed thanks to other suggestions from the reviewer.

2. L13-15: The statement that the dataset "may contribute to..." and "provides the field data for investigating..." is slightly passive. Consider rephrasing to be more direct, e.g., "This dataset is designed to improve our understanding of..." or "The data enable the investigation of fundamental processes...".

Thank you! We have adopted the reviewer's suggestions for more direct phrases in the abstract.

3. L17-18: The data availability can be moved in the appropriate section, avoiding to insert it within the abstract.

We understand the reviewer's remark about the URL in the abstract. According to ESSD's submission guidelines, however, it is required to provide the DOI of the dataset and its citation in the abstract.

4. L83-84: Which is absolute values of these channel depths?

We have indicated the range in channel depth by rephrasing this sentence in the second paragraph of Section 2 into:
... Channel depth generally decreases in landward direction, from several tens of meters in tidal inlets to a few meters in the back-barrier basins. ...

5. L85: It is not so clear, do you mean that sides of tidal inlets are characterized by sandy sediments? While the seaward part is mainly made of mud sediments?

The bed in the tidal basins is generally sandy in the tidal inlet channels, and becomes muddier towards the tidal divides, and towards the mainland coast. We have rephrased our statement in the second paragraph of Section 2 into:
... The bed is generally sandy close to the tidal inlets, becoming more muddy towards the tidal divides and mainland coast in the back of the basins (e.g., Folmer et al., 2023; Colina Alonso et al., 2024). ...

6. L92: This is the first time that you cited the morphological units. First you must report the morphological units in the section 2 and then you can briefly report them in this section.

In the revised manuscript, we have removed the term morphological units from Section 3.1, to focus our introduction on the sediment exchange processes at two different spatial scales.

7. L94-96: The description of the different sections should be moved in the first chapter.

The discussion in Section 3.1, with the field campaigns that we aimed for, is quite extensive. In addition, the link to Sections 3.2 and 3.3, with the field campaigns that we have actually had, may not be clear at first read. Therefore we have included a few lines of text at the start of Section 3.1 to guide the reader through these sections. Although we

agree that in general the outline of an article is provided (only) at the end of the introduction, we think the few lines of text about the structure of Sections 3.1-3.3 are most effective at the start of Section 3.

8. L100-105: The practical considerations for site selection are well-stated. It might be worth adding a brief note on any potential drawbacks of the chosen location. For example, is the site influenced by the dredging and disposal activities mentioned in L100? If so, how might that influence the interpretation of "natural" processes for potential users?

Whether or not the anthropogenic activities are a drawback is in our opinion depending on what one would like to use the presented dataset for. In our research project, the effects of anthropogenic activities (sediment management) are important. In field monitoring, however, these effects are difficult to distinguish from natural variations. We have designed the two measurement campaigns to focus on sediment transport as well as on the underlying forcing mechanisms.

In the revised manuscript, we are more explicit about the combined forcing of natural and anthropogenic processes in the second paragraph of section 3.1. In addition, we have included a statement at the end of this paragraph in which we state explicitly that we focused our measurements on the intertidal areas in the back of the tidal basin, thereby compromising on capturing the full spatial variability within the basin.

… All measurement locations were focused on the back of the basin near the tidal divide, thereby prioritizing a detailed investigation of this area at the expense of capturing the full spatial variability of intertidal areas across the basin.

9. L103-108:The difference in seasons between the two campaigns was chosen only for a spatial discrimination (around tidal divide and channel-shoals). Did you also considered the difference of rainfall rates between winter and spring seasons?

We have not considered the different rainfall rates between winter and spring seasons. Rainfall might affect the measured hydrodynamics and suspended sediment concentrations via freshwater discharges into the Wadden Sea, but the major sluices in the Dutch part of the Wadden Sea are relatively far from the measurement site.

Meteorological conditions in general are expected to affect suspended sediment concentrations via physical and biological effects on the erodibility of intertidal sediment beds (e.g., Nguyen et al. 2019; 2020; Fivash et al., 2024; Dong et al., 2025). Also thanks to a remark from one of the other reviewers, we have included a statement in the third paragraph of Section 3.1 on the limitation that our dataset does not include summer conditions:

… The summer season is not captured in the two measurement campaign, such that effects of biota on sediment dynamics that peak in summer (e.g., Van Der Wal et al., 2010) are not included in the data.

10. L115-116: “and sampling frequency, constrained by instrument battery capacity” So how many days/hours did you consider?

The minimum measurement duration that we aimed for was one full spring-neap cycle. Extending the campaigns to 6-8 weeks increased the likelihood of capturing a range of wind conditions, including occasional storm events. Several instruments operated in burst mode (e.g., ADVs measuring 4 minutes every 10 minutes). Further extending the measurement duration beyond ~8 weeks would have required reducing burst frequency or duration, thereby compromising either data resolution or measurement accuracy.

11. L121: Which is the model of the ADCP?

In the overall introduction to the two measurement campaigns in Section 3.1 (Overall design), we only include the type of instruments that were deployed. More specific information, such as the type and manufacturer of instruments deployed in the two campaigns, is included in Sections 3.2 (The Winter 2023-24 campaign) and 3.3 (The Spring 2025 campaign).
In those sections we discussed the deployment of 5 Nortek Aquadopp Profilers in the Winter 2023-24 campaign, and the deployment of 1 Nortek Signature, 6 Nortek Aquadopp Profilers, and 1 Nortek HR Profiler in the Spring 2025 campaign.

12. L130: Define the range of frequencies.

The A-SEDs measure at an acoustic frequency of 400 kHz, whereas the ADVs measure at an acoustic frequency of 6 MHz. This is now specified in text in Section 3.1:

... Some of the measurement stations in the second (Spring 2025) campaign were equipped with an A-SED (Willemsen et al., 2022; Xu et al., 2023) for acoustic measurements of the distance to the bed, similar to the ADV bed level measurements but carried out at an acoustic frequency of 400 kHz instead of 6 MHz. ...

13. L146 (Storm Pia): It might be worth adding a very brief note on how this extreme event is captured in the data (e.g., "This event provided a unique opportunity to observe sediment transport under extreme conditions, as captured in the high-frequency measurements at stations...").

We have highlighted this extreme event as one of the important aspects of the Winter 2023-24 campaign, in Section 7 (Summary and outlook) of the revised manuscript.

... . Multiple storms are captured during the first (Winter 2023-24) campaign, including one with exceptionally high water level set-up on December 21st, 2023. The strong wind forcing during this measurement period allows for a quantitative analysis of the relative importance of wind- and tide-driven flow and transport. ...

14. L181: If you used OBS and ADV you can estimate the actual water density, while the density of the soil can be assessed from the kind of minerals within the collected samples.

Regarding the water density: The OBS and ADV instruments provide estimates of the suspended sediment concentration (SSC), but not on the amount of dissolved matter. The water density that is relevant to determine the bulk densities of sediment samples is mostly determined by its salinity. We know from other monitoring activities in the Dutch Wadden Sea that ρ_w = 1025 kg/m^3 is a good estimate of the time-averaged water density.
Regarding the density of solids: It would indeed be best to determine the type of minerals in the collected samples, and use that data to determine the density. However, such a laboratory analysis is relatively expensive, and the impact on the results is smaller than the accuracy of the entire sampling procedure. We know from earlier studies in engineering projects (not published) that the clay fraction consists of mostly illite, kaolinite, and chlorite. In combination with the silt and sand fractions that consist of quartz particles, we believe a density in the range of ρ_{sol} = 2600-2650 kg/m^3 is a reasonable assumption.

15. L185: Which is the percentage of HCl used?

To remove shell fragments from the sediment samples, we have used a HCl solution with a concentration of 1 mol/L, as is commonly used for this analysis in the laboratory of Utrecht University. We have now added the concentration of 1 mol/L to the text in Section 3.4.

16. L219-220: This part is referred to the field observation and should be moved in the previous section.

Thank you! We have moved these sentences (in modified form) to Section 3.1.

… Hourly atmospheric pressure measurements at the permanent meteorological measurement station at Hoorn, Terschelling (Figure 1) are available to correct pressure recordings for variations in atmospheric pressure. During the Spring 2025 campaign, however, we installed a pressure sensor in Holwerd (i.e., closer to the measurement site). …

17. L291 (Supplementary Data): The phrase "available upon request" is used for the Rijkswaterstaat data. While this is accurate, it is often less preferred than a direct link. If a public portal or a stable request form link exists, please provide it. If not, the current phrasing is acceptable.

Unfortunately, the Rijkswaterstaat data is not available via a direct link. The water level observations, however, can be requested via an online portal, after which the data is shared (with a download link) via e-mail. The link to this online portal (https://waterinfo.rws.nl/) is included in the text of Section 5.
Other Rijkswaterstaat data, such as obtained by the long-term water quality monitoring program and bathymetric surveys, can only be requested via an online form, for which we provide a link in the main text in the revised version of the manuscript, instead of in the references in the previous version of the manuscript.