Response to reviewer

September 26, 2025

We would like first to thank the reviewer for his/her careful reading and constructive criticism. The suggested modifications have been a decisive help to revise and improve our manuscript. Specific comments are addressed one by one hereafter. Reviewers comments are recalled below in bold font, while text extractions from the revised paper are in italic font.

1 Major Comments

1.1 Along-shore velocity

The paper does not present any information on the alongshore component V of the velocity (magnitude, direction or variability), and how it compares with the cross-shore component U . Is the magnitude of V just very small compared to the magnitude of U ? Since the alongshore direction is part of equations (5) and (6), which are essential to the paper, V must be discussed in the paper. Furthermore, I am worried that the ADVs do not give accurate V because of flow distortion by the frame and alignment of the ADV's bodies in the alongshore direction.

Timeseries of alongshore current have been added in Figure 2 (see panel E). The flow is mainly toward North-West, so the ADVs are fully exposed to the alongshore drift. The magnitude of the along-shore component is not weak, it can even be stronger than the cross-shore component. However, under the assumption of a along-shore uniform configuration, the along-shore component contribution to the cross-shore momentum balance should be limited to the shear stress computation. The following details have been included at the end of Section 3.1.1.

Figure 2E depicts the along-shore component of velocity at both ADVs. The flow direction is mainly toward North-East. The magnitude, which increases with increasing wave height, can overcome the magnitude of the cross-shore component. However, in the cross-shore momentum analysis framework described in Section 2.1.3, the along-shore component mainly acts into the bed shear stress computation.

1.2 Reflection

Wave reflection is brought up a few times (lines 97-98, 140-142, and 294), and motivates computing wave statistics based on the directional wave spectrum. However, there is no mention of how large wave reflection is at this site. How large is reflection? Have you also computed the momentum balance from wave statistics based on frequency(- only) spectra and do the results look significantly different? Could you recommend to the reader whether computing wave statistics based on the signal of incident waves alone is essential to get results you got?

The following details have been added at the end of the Discussion section:

The reflection coefficient, estimated in the sea swell band using the three-gauge method at P9-P11-P13, varies from 0.05 to 0.15 during the monitored period. Neglecting the effect of reflection, i.e. using the full wave signal for the momentum balance assessment, affects the estimation of the wave momentum dissipation term (M_{wd} in Equation 2) due to the inclusion of reflection-based spatial modulation patterns in the gradient of wave action (Eq. 4). This degrades the overall residual, which justifies here the use of separation, but does not affect the general conclusion reached here.

The momentum balance plot with full signal is displayed here in Figure 1.

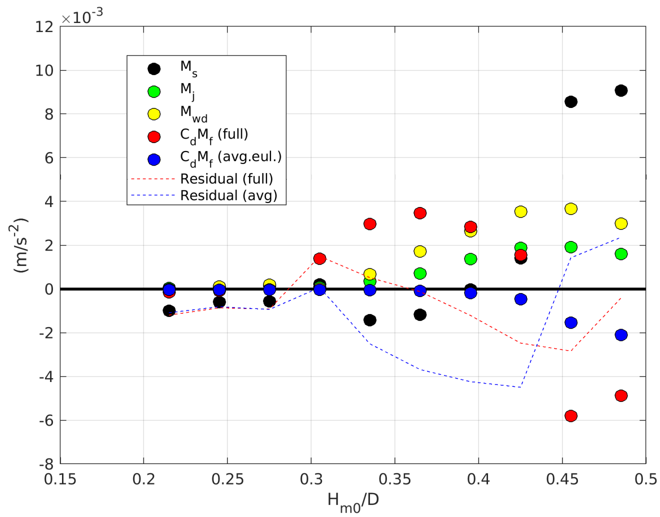

Figure 1: Compared momentum fluxes based on the full wave energy spectra

1.3 Definition of near-bed velocity data point

I don't understand the velocity data point in (i), lines 104-106. There might be a more comprehensive explanation in Sous et al. (2024), but the current manuscript should include a clearer explanation of data point (i).

1. **Data point is the one closest to the seabed, but it is not clear what height that corresponds to. What is the height of "two times the standard deviation of the fine seabed topography"?**
2. **What is the reasoning for placing the average between Ut and Ub below the heights of the bottom-most measurement instead of the average height?**
3. **If you are taking an average, shouldn't data point (i) be irrelevant for the parabolic fit because the average is a linear combination of Ut and Ub ?**

We do agree with the reviewer, this was unclear. A simpler reconstruction is proposed, described in Section 2.1.2 (§ Currents) in the revised version as follows:

A vertical profile is reconstructed using an upper parabolic profile interpolated over three points, namely the two measured velocities at their respective vertical elevations and a zero velocity at the elevation of the lowest wave crest observed during the burst, and a linear profile between the value measured at ADV_b and a zero velocity assumed at the seabed.

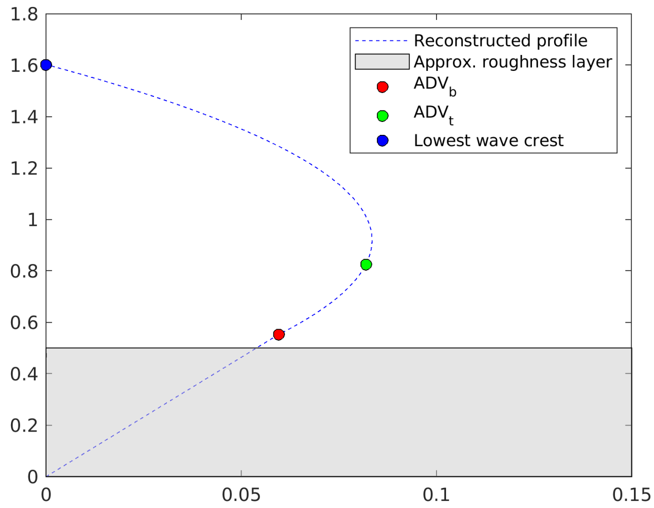

Figure 2: Example of reconstructed profile

An illustration of a reconstructed profile is depicted in Figure 2 here.

It should be stressed that such reconstruction is motivated by the fact that the depth-averaged framework adopted here assumes a depth-uniform wave-averaged velocity, whereas the flow actually depicts a strong vertical shear. Computing U_{avg} from a simple average of $\overline{U_t}$ and $\overline{U_b}$ would result in an overestimated depth-averaged Eulerian cross-shore transport.

2 Minor comments

1. **Numerical simulation: Please indicate in Section 2.2 and/or 3.2 the correspondence between the field site and the geometry of the domain in the numerical simulations. Since your field site is described as a rocky platform, it appears that the flat region in numerical simulations O1-O3 would represent your field site (which is not the case).**

The following precision has been added in Section 2.2:

Note that the flat area in the open cases does not intend to represent the field site: the numerical cases have an open boundary to allow an onshore flow while the real system is closed by a cliff.

2. **l. 5 and 23: Except for these instances, the word "roughness" refers to the shape of the seabed. Because the word refers to a geometrical property, "well-developed seabed roughness" is confusing.**

The two instances have been modified to *complex seabed topography*

3. **l. 9-10: You contrasted "lower mean water level" with "setup". I suggest rewriting to either contrast setdown with setup, or lower mean water level with higher mean water level.**

The sentence has been rewritten in terms of setup/setdown only.

4. **l. 9 and 248: Here you wrote "while under saturation breaking conditions". This wording is a bit confusing because "undersaturation" is a scientific term in itself, I suggest rewriting, where you could use "in conditions of depth-limited wave breaking saturation".**

Both sentences have been corrected following the reviewer's suggestion.

5. **l. 31: Rewrite "rough experiments". Perhaps laboratory experiments simulating rough seabeds?**

"Rough experiments" has been replaced by *the laboratory experiments with rough configuration*

6. **l. 35: The word "water" here is unnecessary.**

Word removed

7. **l. 73: Word "with" appears twice.**

Correction applied

8. **l. 79: It is stated that 4 pressure sensors were deployed, and the identification numbers are P9 to P13, which implies that 5 sensors were deployed. Please rephrase the sentence or change instrument identification to avoid confusion.**

It is indeed confusing. It is now precised that the four pressure sensors are P9, P11, P12 and P13

9. **l. 92-93: Could you add a couple .**

The following details have been added:

The instantaneous velocity is extracted from the profile at 2.1 m above the seabed and combined with bottom pressure to reconstruct directional spectra using the Bayesian Direct Method (Hashimoto, 1997). H_{m0} *is computed by integrating the spectrum over the 0.05-0.35 Hz frequency band and a 270 to 10°angular sector.*

10. **l. 173: Based on Fig. 2, isn't it better to say wave event in the singular?**

Yes, correction done.

11. **l. 179: The terminology in parenthesis is swapped between ADVt and ADVb .**

Thank you for pointing it out, correction done.

12. **Section 3.1.2: When referencing the dots in Fig. 3, specially when differentiating between the frictional terms, I suggest referencing the color of the dots in parenthesis after referencing te corresponding term – e.g., in l. 191, write Using the wave-averaged current (blue dots in Fig. 3).**

Thanks for this good suggestion. Correction applied.

13. **l. 209: commas misplaced and confusing**

Right, commas removed.

14. **l. 210: typo. Should be "where it has been".**

Correction done

15. **l. 256: Missing parenthesis around the Feddersen et al. reference.**

Correction done

16. **Fig. 3: To improve the figure, add a horizontal line in the background along the coordinate 0 in the ordinate.**

Correction done

17. **Figs. 4 and 6: Replace symbols U 0 and Um used in these figures to match the body of the manuscript (U std and Uavg).**

Correction done

18. **Fig. 5: I recommend using a divergent red-blue colormap. Replace Hs with Hm0 because you use the latter throughout the paper.**

Correction done

19. **Section 3.1.3: If I understood correctly, Uavg > 0 can only happen at times when at least either Ut or Ub are greater than 0 in Fig. 2D. From this figure, this only happens for tiny magnitude of Uavg . Therefore, it seems the errors for the corresponding data points in Fig. 4A (i.e., in the onshore regime) should be very big. Remarkably, Figs. 4A and 4C show the results from the onshore case are reasonably consistent with expectations. Please either remove these data points if you think they are not reliable, or add a word of caution regarding the fit to these observations at Uavg > 0.**

That is right, the following precision have been added in section 3.1.3:

For the classical regime of current flowing with wave ($U_{std}/U_{avg} > 0$), few data are provided by the present experiments, during very weak flow magnitude when $U_{avg} > 0$ (see Fig. 2D). Although direct interpretations should be made with caution, note that the sparse retrieved data is observed to reach much higher U_{std}/U_{avg} ratio than previously documented (Lentz et al., 2018).