Reply to Reviewer 2

General comment

This is an excellent manuscript. In this work, the authors discussed the implementation of WW3 and CROCO. They tested the coupled model using a representative case near the Bay of Somme and compared the simulation results against available observations. The paper is very well written. The experiments are designed appropriately. The equations used in the model look correct to me, but I did not derive the equations.

We would like to thank the Reviewer for her/his positive feedback on our manuscript. We appreciate the Reviewer's thorough review and are pleased to hear that she/he found the work well-written and the experiments appropriately designed. In the following, we address both major and minor points raised.

Major points

1) *My major concern is, the simulated wave variables from the experiments are not different by a lot considering the feedback of the current velocity (Fig. 3, 7, 8, 9). Sometimes the new implementations are worse compared with the previous versions. Does it mean the fully coupled model has larger errors?*

Thank you for the feedback regarding the concern about the performance of the newly implemented version of the model. It's important to note that results in Figure 3 show that the predicted bulk wave parameters from the fully coupled model are very similar to those of the previous version of the coupled model, with comparable RMSE and R2 values. However, as for Figures 7, 8, and 9, these results are only from previous versions of the model. We have deliberately chosen not to include results from the newly implemented version in these particular figures, as our focus here was to compare the effects of the different forcing employed.

2) *It would also be desirable if the authors can discuss the extra computational cost introduced by the new implementations.*

The extra computational cost of including the additional spectral term exchanges in the fully coupled version is negligible in the present model configuration, accounting for less than 1% of the computational time required by the previous version of the coupled model. However, it is important to note that the impact of these additional exchanges on computational cost may vary in larger domain configurations. We will include information on the extra computational costs in the manuscript.

Minor points

1) *Line 79: why are the exceptional tides not simulated in this case?*

The exceptional tides were not simulated due to the unavailability of relevant data for that timeframe (september and march).

2) *Line 93: is the CROCO model adequate to resolve the small dunes? I think the small ripples/dunes can be as small as a few centimeters (150 d50).*

The current configuration of the CROCO model with a 100-meter horizontal resolution is not suitable for resolving small-scale features such as small dunes and ripples, which can be as small as a few centimeters in size. Our focus in this study is primarily on larger-scale processes, such as the interactions between currents and waves. However, we acknowledge the limitations in resolving fine sediment patterns. In future phases of our modelling efforts, we plan to enhance the model resolution through nesting, reaching a horizontal resolution of 10 meters and increasing the number of vertical layers. This approach will enable us to better represent tidal dunes, while smaller-scale wave ripples will be parameterised as bottom roughness.

3) *Lines 105-106: the text should be cleaned up.*

The text between lines 105-106 will be cleaned up. We acknowledge that the issue occurred during a minor revision phase when we were instructed to change only the title and availability statement. Unfortunately, an erroneous copy-paste during the final submission included internal notes from another manuscript. We apologise for this oversight.

4) *Line 125: it would be helpful if the author could add more about this equation. What is the unknown variable? How is the equation solved? How are c_theta and c_w represented in the equations?*

We have decided to replace the equation in question with the original one found in the WWIII manual to avoid any potential confusion. Any detailed information about its unknown variables and solution methods is available in the WWIII manual.

5) *Eq. (2): I think these are the equations actually solved in CROCO, why don't the authors put this part in Section 3.2?*

These equations are wave-averaged equations that CROCO solves specifically when wave-current interactions are considered. The original hydrodynamic model in CROCO solves the hydrostatic Navier-Stokes equations. To maintain clarity and consistency, we chose to include these wave-averaged equations in the section dedicated to the introduction of wave-current interactions rather than in the section on the hydrodynamic model.

6) *Line 164: I think the monochromatic approximations are introduced in the latter sections. How about "... are computed from their monochromatic approximations, which are introduced in the latter sections"?*

The text will be modified as suggested to improve clarity.

7) *Line 309: the wind forcing resolution seems too coarse compared with the model resolution. Can the authors comment on this gap?*

We agree with the Reviewer's observation, and we will include a comment in the text to address this gap.

8) *Line 311: I am not sure about the meaning of mean grain size. Is it d50 (mass median diameter)?*

Yes, when we refer to 'mean grain size,' we are indeed referring to d50, which represents the mass median diameter of sediment particles. We will make this clarification in the text.

9) *Line 413: why does the flow fit better with observations?*

The improved fit with observations in the flow is attributed to the inclusion of waves propagating in the direction opposite to the wind stresses. This addition helps smooth out the overly sharp wind-induced current vertical profile at the free surface, a mechanism that is explained in detail in Groeneweg and Klopman (1998).