

Ocean Sci. Discuss., referee comment RC1
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Comment on os-2021-53

Anonymous Referee #1

Referee comment on "Variability of surface gravity wave field over a realistic cyclonic eddy" by Gwendal Marechal and Charly de Marez, Ocean Sci. Discuss.,
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The paper by Marechal and de Marez presents an interesting study on the effects on the wave field bulk parameters of small-scale oceanic currents. The focus is particularly on a specific cyclonic eddy, which is derived from the literature. Wave-current interaction is simulated with the phase-averaged wave model WAVEWATCH III, without source terms. The topic raised in the study is potentially relevant for the wave community, but some aspects of the paper must be improved to make it more understandable and to push ideas further. I, therefore, recommend that authors revise the manuscript addressing the general and specific comments outlined below.

- Title: it is not clear if the study will focus on the scale of the eddy. Reading the manuscript, indeed, it seems that a real distinction between mesoscale and submesoscale is not done, and the eddy is taken as a whole. I suggest, for the title, to focus on the actual subject of the work, that is the variability of the wave field over a realistic cyclonic eddy.
- Line 2: the wave amplitude is mentioned here, while later (Line 13) the wave height is used as the reference vertical scale. Probably, given the results presented in the study, the use of wave height is more appropriate.
- Line 17: an "and" between the two references is probably missing
- Line 17: wave height == > significant wave height
- Line 23: gaz == > gas
- I have not a particular suggestion on how to improve the Introduction (section 1), but at the present stage, it seems to be more a list of results instead of a place where briefly introduce the study in a broad context and highlight why it is important. My suggestion is for a reshaping of this section, to focus on the current state of the research field and key publications.
- Section 2.1 title. I'd rather say: "A realistic cyclonic eddy" (see also my comment below)

- Line 62: define the variable Bu.
- Lines 69-70: here is mentioned the duration of "half a year", while later (caption of Fig1) the duration is 210 days (more than half a year). Please homogenize and keep throughout the whole paper the actual value used for the simulations.
- Fig. 1. Since the current field (speed and direction) is relevant for the wave model, I'd add two panels showing this variable, which will largely help readers to interpret the changes in wave parameters.
- Fig. 1. what is the meaning of f_0 ?
- Fig. 1. Since the current field is not stationary, is there any reason to choose that specific interval (210 days) after initialization? To me, it seems an arbitrary choice that influences the results and must be carefully motivated in the text. Please add a comment, also about what authors mean for "final state of the simulation" (Line 69)
- Figs. 1, 2, and 3. To understand the effect of the eddies on the wave parameters, a comparison with the undisturbed wave field (i.e., no current) is necessary at this stage.
- Page 4. It is defined the surface current, but waves "feel" a wave-averaged current even below the surface. Probably it is not necessary to change the formula, but it is important to specify how waves behave over a realistic current field and that the use of the surface current is an approximation of the real process.
- Fig. 1 and other Figures labelled with X- and Y-axis. Since in the text geographical coordinates are used (i.e., west, north, longitude, ...), I suggest placing them together with labels X and Y on the axes specifications.
- Page 5. It is not clear how simulations were performed. In particular:
 - What kind of "narrow band spectrum" was used?
 - Were simulations initialized with waves travelling from left (west) to right with no boundaries conditions (see the next comment on figures showing the results)?
 - If so, simulations do not reach a stationary condition, therefore results are representative of a specific time step (as it is mentioned later; indeed, at the given time steps, H_s at $X < 100$ km is zero, as well the wave period): does this selection affect results and conclusions? Mind also that, because of the different current fields between unperturbed and perturbed simulations, the two wave fields (for a given T_p and time step) do not necessarily correspond to the same "state".
 - Would have changed the conclusions if, alternatively, the simulation had been done by forcing the field from the boundary and then by trying to reach a steady state for the interior wave field?
- Line 117 "the intensity of the current has been multiplied by five". Does the artificial increase of the speeds cope with the assumption of "realistic cyclonic eddy"?
- Line 122. C_g is the speed of the wave energy.
- Line 124. Longitude, without geographical coordinates specified in the Figures, is meaningless (see my comment above).
- Line 152: it is not easy from the Figures inspection to appreciate the gradient. A new

Figure showing this variable would help. As well it would help a new Figure showing the relative differences between the simulations with different eddies. I let, however, authors decide how to improve the presentation of the results.

- Line 162: what do authors mean by "spurious"? It is shown a value of 360, while it should be 270.

- Line 265: I wonder how one can obtain the Hs field over such a large area. A comment on the available (or planned) instrumentation would be appreciated.