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Discussions

Interactive comment on "Wave-current interaction during Hudhud cyclone in the Bay of Bengal" *by* Volvaiker Samiksha et al.

Anonymous Referee #1

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The manuscript has a subject that is appropriate to the NHESS publication and should be of interest to readers of the journal. The paper is reasonably well written, logically organised, structured and illustrated. The authors present an interesting set of simulations to assess the mutual affects of waves and currents during the passage of the Very Severe Cyclonic Storm Hudhud. The principal results are: (1) Waves contributed 0.25 m to the total water level during the event, which agrees with measurements at Visakhapatnam; (2) Current speed increased from 0.5 to 1.8 m/s for a short time during the event; (3) the two-way coupling increased the current magnitude by 0.25 m/s along the track; (4) The use of wave-ocean coupling increases Hs in 2 m compared to wave model only; (5) waves decrease due to currents when they travel normal to the coast after crossing the shelf area (right side of track) and increased on the left side of track when currents oppose wave direction. Cyclonic systems currently pose

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Discussion paper

one of the most challenging and important meteo-oceanographic phenomena for the earth science community and the study is a valuable contribution. However I have fundamental objections that I believe should be addressed before final publication.

My main concern is related to the overall content and discussions. In the end of introduction, the authors state that "The present study primarily aims at quantifying the impact of wave-current interaction on waves during the Hudhud cyclone". The analysis however seems to be equally focused on the effects of waves on currents and water level. I presume they do so because the only data source available is of a Wave Rider buoy. No current data is available. However, there is no clear discussion on whether the inclusion of current improves wave simulation at the buoy location. The authors just mention the differences in model results show the plots of comparison of model and measurement and let the readers draw their own conclusion. The coupling system increase wave height (0.2 m) at the wave height peak moment. But wave height is decreased before this moment and model actually agrees better with data without the inclusion of currents. Wave period is also slightly better represented in the simulation without currents. If the main goal of the paper is "quantifying" the effect of wave-current interactions on waves, this must be discussed also in terms of improvement and/or deterioration of simulations compared to measurements. At least an attempt should be made. It is an interesting opportunity to address some limitations of these models and if currents are actually beneficial to wave modelling (and vice-versa).

Other specific concerns are: (1) The exact location of the wave rider buoy must be plotted, possibly on the map of figure 1a, so that the reader can know where the validation of the wave model was performed for.

(2) Very little detail is given about wave measurements. Although section 2 is entitled "Data and Methodology" it is basically about the modelling configuration. What is the sampling time of wave information, how is it obtained (spectral method, record length)? This information together with the aforementioned plot of the buoy location may be of interest to readers.

(3) Why do the authors decide for the set of physics of growth and dissipation from Cavaleri and Malanotte-Rizzoli (1981) and Komen et al. (1984)? These old parameterisations and especially the Komen et al. dissipation form are proven to not be adequate in non-standard conditions, as in opposing currents, for example (see Ardhuin et al JPO (2012) and Rapizo et al (JGR 2017)). The dissipation form in Westhuysen et al (2007) shows better performance than the Komen et al. term in adverse currents (Rapizo et al, 2017). The newly implemented in SWAN and recently released 'ST6' physics (Rogers et al, 2012) performs best in conditions of effective currents Rapizo et al (JGR 2017), which is the subject of investigation here. If the old physics are used instead, a justification must be given.

(4) I find it hard to analyse the differences in current speed shown in Fig. 5 (especially for figure (b)). Although it is interesting to see the pattern produced by the cyclone landfall, all figures show similar patterns. I suggest here to plot (b) and (c) as current speed differences (similar to Fig. 10 bottom panels).

Other minor points: Line 22: "Studies show that waves contribute to local currents, water level and mixing." By mentioning "Studies" I feel at least one reference is needed here.

Line 24-26: "Several studies have been carried out relating to individual processes, but not many on interaction between the processes. Therefore, we need to take into account different processes that impact a specific process." Very confusing, many repetitions of word "process". Rephrase.

Line 34: "effected" => "affected"

Line 37: "The wave processes that impact the coastal environment are:" There are many other wave-related processes that impact the coastal environment other than the ones listed (wave set-up, wave-current interactions and breaking-induced mixing). The first phrase should be rephrased to something like: "Some of the relevant wave processes that impact the coastal environment are as follows:"

Line 55: SWAN stands for Simulating Waves Nearshore, not "in Nearshore".

Line 93: Buoy coordinates are wrong. (same for legend in Fig. 4, 6 and 8)

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