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Ocean Science Discussions

Interactive comment on "Observation on dominance of swells over wind-seas in the coastal waters of Gulf of Mannar, India" *by* M. M. Amrutha and V. Sanil Kumar

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General comments (overall quality of the discussion paper) The paper describes the seasonal variation of different wave conditions (swell-dominated and wind-dominated) within the Gulf of Mannar. At times it is difficult to determine where previous cited papers by the same authors end and the current study begins. Given that much of the discussion focuses on the locally-generated wind waves and the swell waves, I find it strange that no detail is provided on the separation method. The authors simply state (P3, L31) that '[wind and swell waves] are separated to identify different wave components at the study location.' This should be addressed. The study is motivated

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based on some of the adverse effects of swell waves, but the importance of the findings in this context should also be discussed.

Reply: Thanks for all the suggestions. We have incorporated all the suggestions in the attached revised manuscript in track change mode.

Now the details of the separation method is added as below under section 2.1. The method proposed by Portilla et al. (2009) is used to separate the wind-seas and swells from the measured data. The 1-D separation algorithm is on the assumption that, the energy at the peak frequency of a swell cannot be higher than the value of a Pierson-Moskowitz (PM) spectrum at the same frequency. The ratio between the peak energy of a wave system and the energy of a PM spectrum at the same frequency is above a threshold value of 1, the system is considered to represent wind-sea, else it is taken to be swell and a separation frequency fc is estimated. Swell and wind-sea parameters are obtained for frequencies ranging from 0.025 Hz to fc and from fc to 0.58 Hz, respectively. Apart from describing the seasonal variations, the present study identifies the predominant wave systems in the western GoM. Now we have added the inter-annual variation in wind-sea and swell percentage in the surface variance based on numerical model results at 8 N; 78.25 E along with the change in wind-sea and swell percentage during one year along the longitude 78.25o E when the waves approach from 7o N to 8.5o N in the GoM. Percentage occurrence of long-period waves are presented in the manuscript.

Specific comments (individual scientific questions/issues) âĂć P2, L6: Much of the discussion in this section uses the classification of Arena and Guedes Soares (2009). The authors may wish to move the citation of this paper to an earlier point in the section for clarity. Also, although their paper contains a discussion on nonlinear wave groups, any nonlinear effects seem to be neglected in the current study.

Reply: Moved the citation of Arena and Guedes Soares (2009) to beginning of the paragraph. Now we have discussed the nonlinear effects on surface elevations through skewness under last para of section 3.1. The nonlinearity in the surface elevations are reflected in the sharpening of the wave crests and the flattening of the wave troughs and these effects are reflected in the skewness of the sea surface elevation (Toffoli, 2006). The positive skewness value indicates that the wave crests are bigger than the troughs and zero skewness indicates linear sea states. Figure 12 shows the variation of skewness with significant wave height, mean wave period and mean wave direction. The waves from the east are mainly the wind-seas and gave low skewness values. The high skewness values are for long-period swells (Tp > 16 s) superimposed on the wind-seas. The increase in nonlinearity with the increase in the Hm0 is not predominant at this location (Figures 12a to 12c). The abnormality index (Hmax/Hm0) more than 2 is observed during 8.5% of the time, but it is only 1.5% for waves with Hm0 more than 1 m (Fig. 5d). Toffoli, A., Onorato, M., Monbaliu, J.: Wave statistics in unimodal and bimodal seas from a second-order model, European Journal of Mechanics B/Fluids, 25, 649–661, 2006.

âĂć P2, L9: The Gowthaman et al. (2013) paper provides observations relating to the seasonal dominance of swell and wind waves in the northern GoM. Given the relevance to the current study, I would have expected some further discussion/ analysis on their findings. This is also important to clarify the specific advance to knowledge provided by the current study.

Reply: Now we have discussed the findings of Gowthaman et al. (2013) in the present study under section 3.2.

âĂć P2, L10: Following on from the previous point, the ‘lack of measurements’ mentioned in this section seems to contradict the start of the next section (which uses measurements in this location). Which areas are well known, and which datasets have previously been published?

Reply: The Studies on waves in Indian waters based on measured wave data covering 1 year and above is now presented as Table 1.

âĂć P2, L17: A (Lagrangian) wave buoy will move with the waves, unlike an (Eulerian) wave staff. Some discussion of the effects of the buoy motion on the measured quantities would be useful here (see Longuet-Higgins, 1986 'Eulerian and Lagrangian aspects of surface waves' in JFM 173).

Reply: Now we have discussed it under section 2.1. A moored wave buoy may travel around a large crest in a short-crested sea, or even be dragged through a large crest if it reaches the limit of its mooring line (Whittaker et al.,2016). Additionally, the Lagrangian buoy motion will still affect the wave measurements of an idealised buoy capable of perfectly following the free surface motions. Although the linear contributions to the free surface elevation measured by a surface-following and fixed sensor are equal, it is generally assumed that this Lagrangian motion will prevent the buoy from measuring the second harmonic component of steep deep-water waves obvious on a wave staff record (Longuet-Higgins, 1986). These effects are not considered in the present study. Whittaker, C. N., Raby, A. C., Fitzgerald, C. J., Taylor, P. H., 2016. The average shape of large waves in the coastal zone, Coastal Engineering 114, 253–264.

âĂć P3, L4: The specific contribution by this paper is even less clear when it appears that all of their 'data and methods' material (a model comparison with measured data) has already been published in Amrutha et al. (2017).

Reply: The data used in the study is not published in Amrutha et al. (2017). Amrutha et al. (2017) deals with the long-period waves in the Arabian Sea whereas the present study is on the wave characteristics in western Gulf of Mannar. Only a similar model setup was used in the present study. Hence, we have deleted this sentence and now added the model validation part as per suggestion of both the Referees.

âĂć P4, L24: The comments about differences in wind and wave direction should be linked to the discussion of the relative water depth (and whether the waves were in the 'deep' regime) in the following paragraph. The differences in these effects on wind and swell waves (if any) should also be discussed in detail.

Reply: Now we have added a figure (Fig. 8) showing the difference in wind and wave direction verses the relative water depth (d/L) and discussed in section 3.1.

Technical corrections, suggestions and comments A general comment is that the paper is made slightly more difficult to read by tense inconsistencies.

âĂć P1, L7: This may be a style issue, but it would be best to begin the first sentence of the abstract with the active, rather than the passive, voice. This sentence could be better worded as ‘Wind seas typically dominate over swell seas in coastal gulfs.’ Reply: Corrected.

âĂć P1, L8: ‘is used’ should be ‘are used’ (this refers to the plural ‘Waves’). Reply: Corrected.

âĂć P1, L17: ‘Gulf of Mannar’ should be ‘The Gulf of Mannar’. Reply: Corrected.

âĂć P1, L20: I’m not sure that ‘implications’ is the correct word here. Normally you would state what the implications are. It may be more appropriate to use ‘effects’ or ‘impacts’ in this sentence. Reply: Corrected as "impacts".

âĂć P1, L21: The ‘similar change’ is ambiguous. Presumably, you are referring to the directionality of the waves. Reply: corrected as "changes in the directionality of the surface waves"

âĂć P1, L24: The values should be moved to after the respective ‘monsoons’ referred to. Reply: Corrected.

âĂć P1, L26: The word ‘represent’ may not be the best way to state this. Some suggestions are ‘comprise’ or ‘consist of’. Reply: Changed to "comprise".

âĂć P1, L27: This sentence implies that wind waves dominate in all of these areas (coastal regions, bays and gulfs). Is this what the authors wish to say? Reply: Yes.

âĂć P2, L4: ‘are with multiple peaks’ should be re-worded as ‘contain multiple peaks’. Reply: Corrected.

âĂć P2, L26: ‘for frequency’ should be ‘for frequencies’. Reply: Corrected.

âĂć P2, L15: Again, this sentence could begin with the active voice: ‘This study uses measurements of waves. .’ Reply: Corrected.

âĂć P3, L12: ‘occur’ should be ‘occurred’. Reply: Corrected.

âĂć It would be useful if the radii of the wave roses presented in figure 4 were consistent for all subplots. Reply: Now made uniform.

âĂć P4, L14: ‘Fifty three percentage’ is not a common way to express percentages. This should simply be written as ‘53 Reply: Corrected.

âĂć In the pdf of the manuscript discussed in this review, the first three paragraphs within Section 3.2 (Wave Spectra) were repeated. The repeated content should be removed. Reply: Repeated content deleted.

Please also note the supplement to this comment:
https://www.ocean-sci-discuss.net/os-2017-16/os-2017-16-AC2-supplement.pdf

Interactive comment on Ocean Sci. Discuss., https://doi.org/10.5194/os-2017-16, 2017.

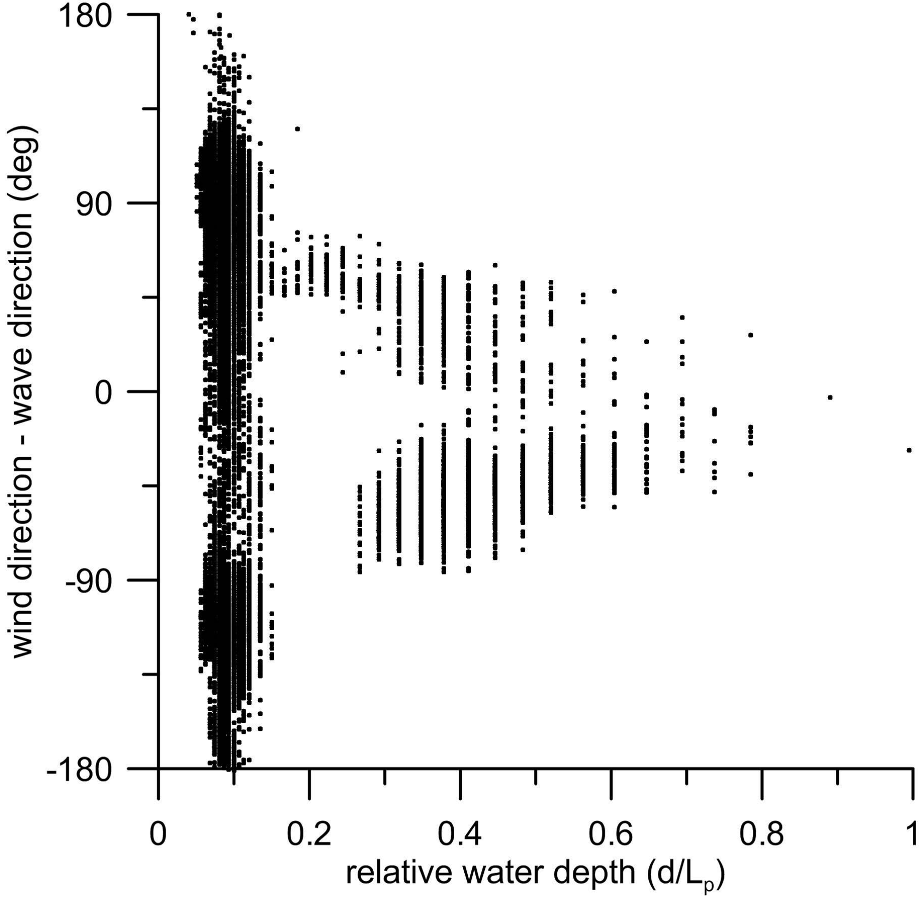

Fig. 1. Figure 8. Variation of difference in wind and wave direction with relative water depth

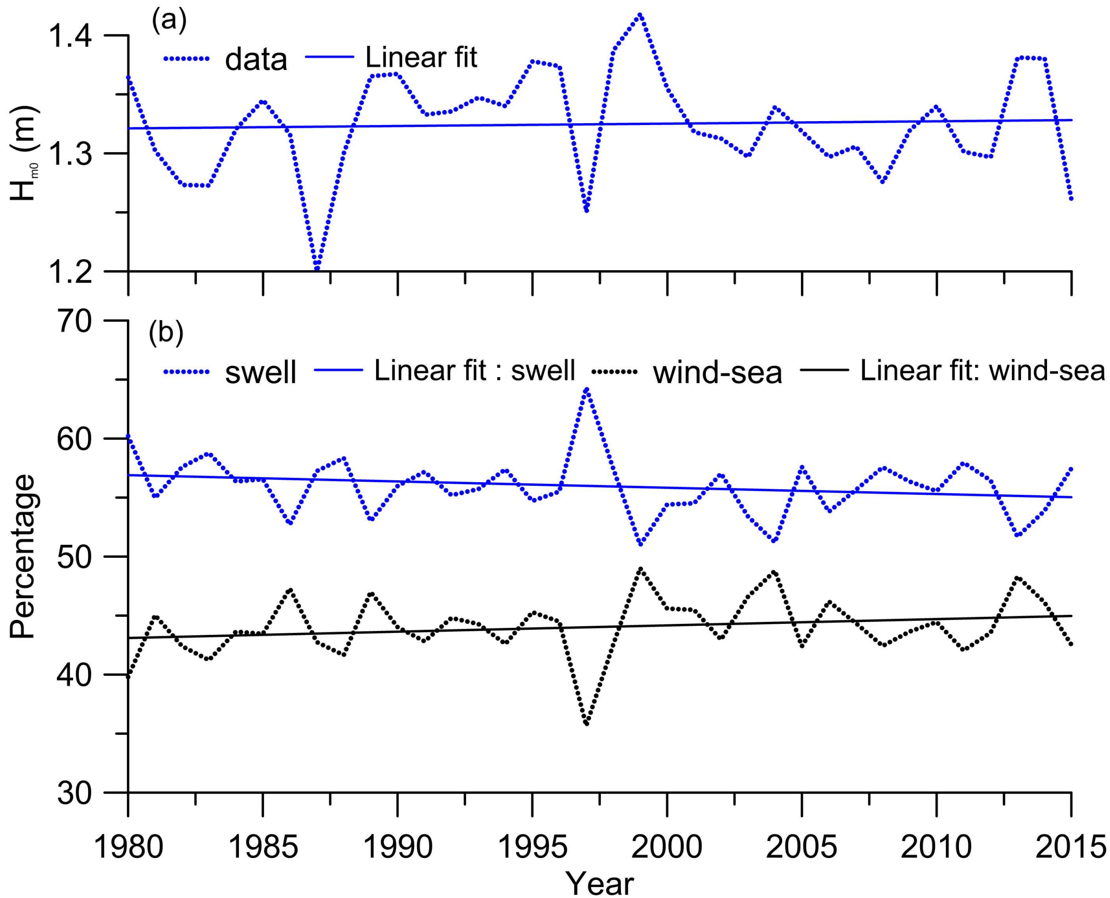

Fig. 2. Figure 11. Variation in a) significant wave height and b) percentage swell and wind-sea at 8ïĆř N; 78.29ïĆř E during 1980-2015. Linear trend is also presented

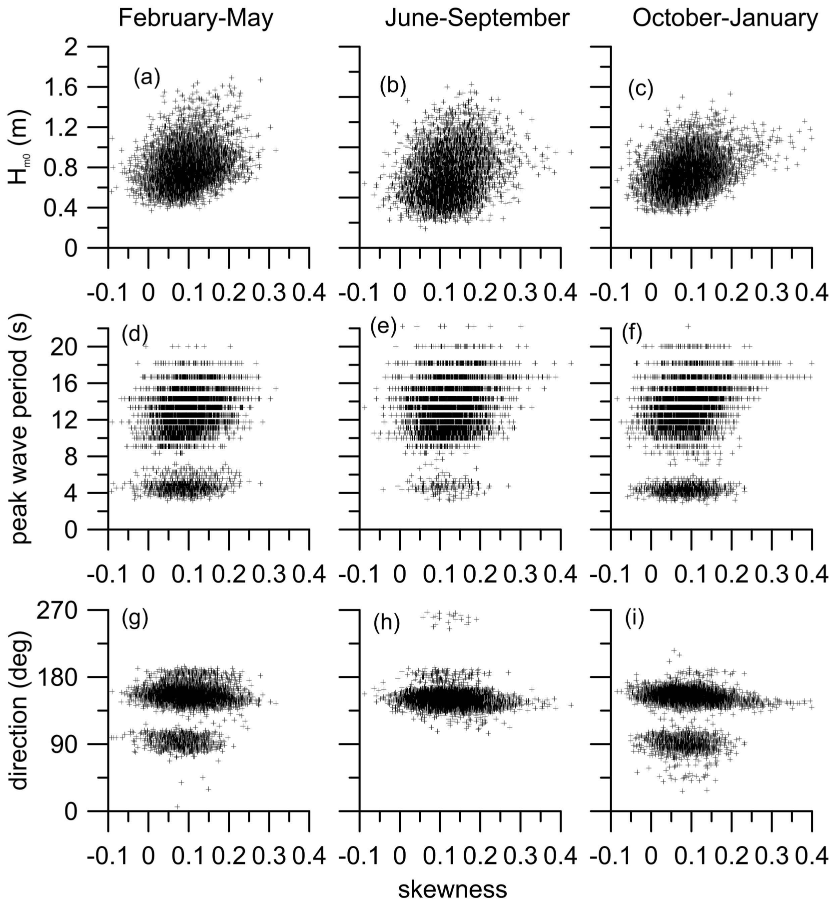

Fig. 3. Figure 12. Variation of skewness with significant wave height, mean wave period and mean wave direction in different seasons

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