Review report of 'Rogue Wave Indicators from Global Models and Buoy Data'

by Azevedo, L. *et al.*

EGUsphere-2025-2031

The manuscript presents findings from the analysis of datasets from CDIP wave buoys and model predictions of wave spectra, with a special focus on the occurrence of rogue waves. It addresses the key question of how to find representative indicators to rogue wave events in the evolution of wave spectra, where the crest-trough correlation and its temporal variation are emphasized. The manuscript also reports that the number of rogue wave events is underestimated by spectral models comparisons with these from wave buoys. The study highlights the importance to improved representation of rogue waves in spectral models.

Assessment: The manuscript has clearly stated objectives which have been well realized, where knowledge gaps based on the state-of-the-art are identified. Conclusions are important which are well supported by the results. An important question of how to well represent rogue wave events in spectral models has been addressed by the authors. The solution through the use of the spectral narrowness, the crest-trough correlation and its temporal variation are proposed. The manuscript is in general very easy to read. I believe the work is of interest to the wave community and has potential of creating a long-term impact. There are a few minor points listed below for the authors to consider.

Minor points:

1. Abstract, last paragraph of the introduction and conclusion: it might be sensible to state clearly the focus is on rogue waves in deep water.

2. In the second paragraph of the introduction, physical mechanisms for the formation of rogue waves are reviewed in the last 2 decades. However, a few most recent ones are not reviewed, for instance, the one by Li *et al.* (2021) as a result of the superposition of free and bound waves atop a depth transition, and coupled interaction between waves and shear current by Li & Chabchoub (2024). More plausible mechanisms for the generation of rogue waves atop a depth transition can be found in the review by Li & Chabchoub (2023).

3. In the introduction, it might be sensible to state clearly the differences between wave phase averaged model and wave phase resolved models. The main focus of the manuscript is the former. One would argue the conclusions drawn from the manuscript may not be applicable to wave-phase resolved models (see the next point for further explanations).

4. The paragraph near line 205 where the crest-trough correlation is defined. Based on the definition of crest-trough correlation, it is clear that it cannot represent the mechanism for rogue wave formation owing to linear wave focusing as the spectral density $S(f)$ does not change in the process of linear wave focusing. It might be sensible to provide some representative values of the ratio for better physical understanding, for instance, the value for a linear Gaussian spectrum and the same spectrum while using a second-order Stokes theory. Would this be likely?

5. At the beginning of the results and discussion, it is useful to state clearly the time window used for the analysis.

6. Line 582 where 75.3% agreement is shown. It would be very useful to provide some comments on the physical characteristics for these which do not support the hypothesis. These may suggest possible future directions to work on.

References

Li, Y & Chabchoub, A 2023 On the formation of coastal rogue waves in water of variable depth. *Cambridge Prisms: Coastal Futures* **1**, e33.

Li, Y. & Chabchoub, A. 2024 How currents trigger extreme sea waves. The roles of Stokes drift, Eulerian return flow, and a background flow in the open ocean. *Geophys. Res. Lett.* **5** (6).

Li, Y., Draycott, S., Zheng, Y., Lin, Z., Adcock, T. A. A. & van den Bremer, T. S. 2021 Why rogue waves occur atop abrupt depth transitions. *J. Fluid Mech.* **919** (R2).