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Comment

## ***Interactive comment on “Time-frequency analysis of the sea state with the “Andrea” freak wave” by Z. Cherneva and C. Guedes Soares***

### **Anonymous Referee #4**

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The manuscript presents a time-frequency analysis of a record reporting a freak wave (known as “Andrea”). Three separate groups are selected within the time series and post-processed using the Wigner spectrum. Overall, the manuscript is not well written and lacks important details. Further, some of the main conclusions are speculative. In this present form, the manuscript is not suitable for publication in NHESS.

Specifically:

1) The introduction is very general and offers a long historical description of time-frequency spectra. However, it lacks a clear description as to why the Wigner spectrum should be used for the analysis of ocean waves. Compared with e.g. wavelets, what can the Wigner spectrum offer to improve time series analysis? Furthermore,

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I do not understand what the main purpose of this analysis is. Apart from applying the Wigner spectrum to one time series, what do the authors expect to discover or demonstrate?

2) In section 2.1, there is reference to the carrier wave frequency  $\omega_0(t)$ . It is stated that the carrier wave frequency is different from the peak frequency. This is not at all clear. Why the frequency of the carrier wave is different from the peak frequency? Does the carrier wave refer to the individual group? Also there is a reference to a local frequency. What is that?

3) Section 2.2 describes the Wigner spectrum. As it is written, it looks as Wigner spectrum is a linear tool like the FFT. It is mentioned that equation (5) allows the estimation of high order time-frequency spectra. How? What does high order spectra mean? What sort of nonlinearity can be detected? Only referring to (Cherneva and Guedes Soares 2008) is not enough. Considering that the Wigner spectrum is the main tool used for the present study, a much more detailed description is expected.

4) Section 2.3 describes Benjamin Feir Instability. Honestly, I do not understand the reason why this section is presented. Is there any connection with the Wigner spectrum? Can these higher order spectra detect BFI? Also, there is no further mention to BFI in the rest of the manuscript.

5) Section 3 discusses results. Unfortunately, the text is very confusing.

6) There is reference to tank experiments. What experiments do the authors refer to? Why are they not described? Also there is reference to real sea states (line 19, page 1491). What are these sea states?

7) Spectral downshifting generated by BFI takes some time to develop. I do not quite understand the downshifting of energy showed in individual wave group (Fig. 3, for example). The time window is far too short for nonlinear mechanisms to develop.

8) The statement in the paragraph between page 1491 and page 1492 is unclear. Also,

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statement like “...possibly it will transform to a short group similar to that of the New Year Wave after several wavelength” is speculative. How can the author prove this?

9) Again, the statement “It can be suggested that the complicated time-frequency spectrum picture of the group III from Fig. 1b possibly is a result of interaction of wave components coming from separate directions” is speculative. There is no mention to directional property. How can this statement be supported?

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 1481, 2014.

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