Review

on the manuscript "A Statistical Analysis of Rogue Waves in the Southern North Sea" by Ina Teutsch, Ralf Weisse, Jens Moeller, and Oliver Krueger, submitted for publication in NHESS.

The paper represents a nice study of a huge dataset of the surface displacement records collected through 6 years by 11 gauges installed in a region of the North Sea. I would say, every study which deals with such a large amount of data is an important event in the oceanography. In my opinion, the manuscript is clearly written with thorough discussion of the results of the processing and with a perfect graphical representation. There is practically no technical drawbacks in the text. I assume, the study is far from exhaustive, and a series of subsequent publications may be anticipated. However, there is a set of important findings and conclusions formulated through the text and in the discussion and conclusions. I congratulate the authors with such a good job done, and believe that the NHESS should be happy to publish this paper. At the same time, I believe that some issues require more clarification / mentioning / discussion, I list them below. They should require a minor modification of the texts which should improve its quality, in particular should help to depict a more general picture of the problem.

1. I suggest another possible explanation of the difference between the statistics obtained by the radar and by the buoys, which is the different sampling frequency. The low frequency of the buoys 1.28Hz may lead to a poor description of short and sharp steep crests. If so, the records by the radars are more trustworthy.

2. The authors compared different subsets of the data (seasonal, in rough sea states, recorded by buoys or radars, etc), but not sorted basing on the spectral properties (presence of one or several wave systems, angle spectrum width, etc.). If the corresponding data is available, can this analysis be performed in the future?

3. The depth conditions should be described and discussed more thoroughly. According to Table 1, the depths seem to correspond to fairly shallow water. In the paper they are divided into shallow and deep with respect to the condition $kh = 1.36$, which is very mild if one wants to observe the effect of the Benjamin – Feir self-modulation. I suggest to indicate the magnitudes of kh (or range of them) in Table 1.

   When comparing with other observations (Sec. 4 Discussion) with respect to the probability distribution laws (Rayleigh or Forristall), the distinction between the depth conditions is not always made. However, the issue whether the PDF is better described by the Rayleigh or the Forristall distribution (and why it differs in different researches) is probably even more important than the peculiarities of the PDF tails.

4. Some seemingly worthy references are absent in the paper; they may be relevant:

   Chien, H., Kao, C.-C., Chuang, L.Z.H. (2002) On the characteristics of observed coastal freak waves. Coast. Eng. J. 44, 301–319.

   Liu, P.C., MacHutchon, K.R. (2006) Are there different kinds of rogue waves? In: Proc 25th Int Conf OMAE 2006, Hamburg, Germany, 2006, OMAE2006-92619:1–6.

   Mori, N., Liu, P.C., Yasuda, T. (2002) Analysis of freak wave measurements in the Sea of Japan. Ocean. Eng. 29, 1399–1414.

   Paprota, M., Przewlocki, J., Sulisz, W., Swerpel, B.E. (2003) Extreme waves and wave events in the Baltic Sea. In: Rogue Waves: Forecast and Impact on Marine Structures. GKSS Research Center, Geesthacht, Germany.

Pinho de, U.F., Liu, P.C., Ribeiro, C.E.P. (2004) Freak waves at Campos Basin, Brazil. Geofizika 21, 53–67.

A review and discussion of the effects of the averaged wave steepness, spectral properties, etc. on the likelihood of the rogue wave occurrence, robustness of the rogue wave estimators may be found in Chapter 1 of the book:

Kharif, C., Pelinovsky, E., Slunyaev, A. (2009) Rogue Waves in the Ocean, Springer-Verlag Berlin Heidelberg.

5. It is mentioned in the end of Sec. 2.1 that the zero-upcrossing method is employed in the study with the reference to Goda (1986) that the down-crossing analysis should lead to the same results. Have the authors checked that the zero-downcrossing approach yields the same PDF? A clear difference between the up and down-crossing analyses was found in the numerical simulations [Sergeeva, A., Slunyaev, A. (2013) Rogue waves, rogue events and extreme wave kinematics in spatio-temporal fields of simulated sea states. Nat. Hazards Earth Syst. Sci. 13, 1759-1771; Slunyaev, A., Sergeeva, A., Didenkulova, I. (2016) Rogue events in spatiotemporal numerical simulations of unidirectional waves in basins of different depth. Natural Hazards 84, 549-565] (rogue wave shapes possessed asymmetry in rough sea states having deeper following troughs), and the in-situ observations [Pinho de, U.F., Liu, P.C., Ribeiro, C.E.P. (2004) Freak waves at Campos Basin, Brazil. Geofizika 21, 53–67]. Can the authors support or deny the difference?

6. End of the caption for Table 2: "*pear year*" should be corrected.

7. To the end of Sec. 2.2. M. Cristou and K. Ewans admitted that the applied quality check procedure rejected as possibly erroneous a much greater portion of time records with rogue waves compared to 'ordinary' time records, what could affect the eventual PDF. Can the authors give the portion of discarded 30-min samples with potential rogue waves versus the portion of discarded records with all waves below the threshold of $2H_s$?

8. Fig. 3: the red and orange lines cannot be distinguished when printed in my color printer. Please change the colors.

9. Fig. 5, 6. Such large anomalies of statistically valid annual rogue wave frequencies may probably mean that the man part of the registered rogue waves was caused by a few localized in time and space sea states which passed through the measurement locations. Are the rogue wave events at a given location clustered in time? This may be a question to be answered in the next paper.

10. Figs. 8, 9 are plotted for large H_s. Could you please give some estimation of the threshold value of H_s, how large it was.

11. Line 240: please remove the repetition "*at at the 95%*".

12. Lines 285-287. It is not really clear why the two limits of the dispersion relation for shallow and deep water were applied, as most of the conditions seem to correspond to the intermediate depth. What was the interval of kh in the experimental data?

13. Fig. 12. Looking at plots in (a) and (b) ((a) particularly) I would say that in shallow water rogue waves preferably occur in the conditions of a small steepness. Can you agree with this conclusion?