Report on "A statistical analysis of rogue waves in the Southern North Sea" by I. Teutsch, R. Weisse, J. Moeller and O. Krueger

In this manuscript the authors discuss a dataset of field measurements collected during six years at eleven measurement sites in the southern North Sea. Such a dataset is rare and very valuable. The analysis is presented in an appropriate way and the results are interesting and useful. I recommend publishing this manuscript after the following remarks that may improve the manuscript are considered:

1. In line 17 you refer to the old "highest third" criterion for significant wave height. However, the Rayleigh distribution in equation (1) with the parameter values as specified in line 50 and most of the subsequent developments are probably based on the modern "four standard deviations" criterion, thus you are in fact defining the "significant wave height" in two different ways in your manuscript? Please be explicit about this!

2. In lines 46–50 it is probably not accurate to say that a sea surface that is a stationary Gaussian process has wave heights that are Rayleigh distributed according to equation (1) with the given reference parameters. This approximation is correct for the limit of an infinitely narrow-band process, but needs to be adjusted to account for the effect of finite spectral bandwidth in order not to overpredict the true values, see e.g. Næss (1985).

3. In line 113 you write $\overline{T_z^{-1}}$, but you probably want to write $\overline{T_z}^{-1}$.

4. In equation (2) you should explain that C is crest height.

5. In figures 7 and 9 it is not clear if the red curve conveys information different from the histogram of blue bars? If you declare the total number of waves and the bin width (which you should declare) then these two graphical representations are equivalent?

6. In lines 280–281 you use the water depth $kh = 1.36$ "below which nonlinear instabilities are mostly absent (Benjamin & Feir, 1967)". It is true that if you limit to uniform waves with long-crested perturbations you find instability only for $kh > 1.36$ (Benjamin & Feir, 1967). If you allow the uniform waves to have short-crested perturbations you also find instability below this threshold (Benney & Roskes, 1969). For your field measurements you have to accept that your waves are short-crested.

7. In lines 280–281 you use the water depth $kh = 1.36$ to "distinguish between deep and shallow water waves", in order to select between two different asymptotic approximations of the full dispersion relation. However, this is a stability limit for long-crested waves, and does not distinguish different asymptotic shapes of the dispersion relation.

   Please explain why you want to approximate the full dispersion relation here rather than to use the full relation!

8. In line 373 you refer to Trulsen *et al.* (2012) for experimental results regarding kurtosis and skewness over a bottom slope. You may also want to refer to Trulsen *et al.* (2020) where substantially more experimental evidence was presented for kurtosis and skewness over a shoal. From their work there appears to be different depth regimes with different behaviors. It could be interesting if you discuss your depths and observations in relation to the different depth regimes anticipated by Trulsen *et al.* (2020).

References

Benjamin, T. B. & Feir, J. E. 1967 The disintegration of wave trains on deep water. *J. Fluid Mech.* **27**, 417–430.

Benney, D. J. & Roskes, G. J. 1969 Wave instabilities. *Studies Appl. Math* **48**, 377–385.

Næss, A. 1985 The joint crossing frequency of stochastic-processes and its application to wave theory. *Appl. Ocean Res.* **7**, 35–50.

Trulsen, K., Raustøl, A., Jorde, S. & Rye, L. B. 2020 Extreme wave statistics of longcrested irregular waves over a shoal. *J. Fluid Mech.* **882**, R2.

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