Reply to the Referee #1

We would like to thank the Referee #1 for the valuable comments.

COMMENTS BY THE REFEREE
First of all, the paper concludes that the results obtained through this procedure agree satisfactorily with the data recorded at the Ekofisk field. This statement is far from being clear from the text, for the following reasons.

Indeed, I found no mention in the text of data from the Ekofisk field (except those in table 1). As far as I understood, data plotted on figures 2, 3, 4, and 5 are obtained from the WAM model (the text is not clear on that point). The origin of figure 6 is not clear neither. Is it an output of the WAM model, or an ensemble average of the simulations with HOSM, initiated with the corresponding WAM data? In any case, I could not understand how to compare the results with any data from the field.

ANSWER BY THE AUTHORS
We have realised that the explanation of the Figures 2-5 is a bit confused. While Figs. 2 to 5 are representations of hindcast data generated with WAM, Figs. 6 to 9 are obtained from the HOSM. In this respect, Fig. 6 summarises the statistical properties of the instantaneous surface elevation at time of each hindcast output. The plots were obtained by using the hindcast data (and particularly the full directional spectrum) as input for generating an initial (linear) surface for the HOSM. The latter provided the temporal evolution of the initial surface, accounting for the effect of nonlinearities on the initial surface elevation. Maximum values of the amplitude, skewness and kurtosis are reported throughout the storm. Figs. 7 to 9, on the other hand, only represent the temporal evolution as simulated by the HOSM of an initial surface at the time peak of the storm.

As we do not have direct measurements of the surface elevation other than the 17-minute time series showing the most extreme wave, a direct comparison of the statistical properties between field observations and model are not possible. The only comparison that is allowed by the data set is the one on the maximum-recorded crest height $C\mathrm{max}/H\mathrm{s}$.

In the revised version of the text we have carefully rephrased the text describing the figures to eliminate any source of confusion.

COMMENT BY THE REFEREE
Furthermore, a sentence at the end of section 4 states that the location used in simulations is not the same as location of the Ekofisk field. Another, just before, states that the exact time of the event is not covered by the simulation. These arguments are used to explain differences with the occurrence of the Andrea rogue wave. Are they statistically relevant, or not? And thus, why were these choices made for?
Then, results of the HOSM model are plotted on figures 7, 8 and 9. The time scale presented is really different from the time scale of the WAM model. It is found that skewness, kurtosis, and normalized wave height vary significantly within this time scale.

However, it is not clear how this result can be interpreted.

ANSWER BY THE AUTHORS
The location used in the study was chosen because it was the nearest grid to Ekofisk where the hindcast data were available to the authors. The hindcasts are usually run for some specific grid points, and only dedicated studies are run for a specific location by met-offices on a request of a user and required funding. The storm covers always some area, it is not limited to one location only and information from nearby locations provides also valuable input to an analysis of a specific location. The main idea of the study is the coupling of the ECMWF hindcast data together with HOSM. Although the location is not the same the presented comparison with the measured wave characteristics points out that the coupling of the ECMWF hindcast data together with HOSM can be a good supporting tool for an analysis of field data which are in most cases affected by sampling variability and the suggested approach should be exploited further.

Figures 7, 8 and 9 present the results of numerical simulations carried out by HOSM for a given wave spectrum obtained from WAM at the time of the storm peak; 8 Nov. 2007, 18:00 UTC, 9 Nov. 2007, 00:00 UTC and 9 Nov. 2007 06:00 UTC. The surface elevation has been evolved for the 70 Tp time period in order to capture modulational instability. Therefore the time scale presented in the figures is different from the time scale of the WAM model. The figures show how the wave characteristics evolve during the 70 Tp time period for a given input wave spectrum.

COMMENT BY THE REFEREE
Finally, in abstract, it is claimed that wave profiles comparisons are made with the Ekofisk records, but I could not find such a figure in the document.

ANSWER BY THE AUTHORS
We thank the referee for this comment. Indeed we did not perform any direct comparison with field data apart from the wave characteristics at the time of the storm peak. The abstract and the manuscript have been revised to clarify this issue and hence eliminate any confusion.

COMMENT BY THE REFEREE
Secondly, concerning the procedure of coupling itself, and the model used, some details are needed. The equations presented in section 4 suggest that the HOSM model used is a 2D version. The initialization of such models, however, is not straight forward, especially in two dimensions of propagations. Indeed, the conversion of linear spectrum into nonlinear surface requires a detailed procedure, and several of these procedures exist (see G. Ducrozet, F. Bonnefoy, D. Le Touzé, and P. Ferrant, "3-D HOS simulations of extreme waves in open seas", Nat. Haz. Earth Sys. Sci., 7, 109-122, 2007 and references therein). What was the choice of the authors?

ANSWER BY THE AUTHORS
We thank the referee for pointing out a lack of sufficient description of the model coupling. In the amended version of the manuscript the text has been improved for clarity.

For the present study, the 2D version of the potential Euler equations have been initialized by an input linear surface obtained as a FFT of the hincast spectrum. Nonlinear features of the surface (i.e. second and higher order contributions) are automatically generated by the model, provided a sufficiently long temporal evolution is simulated. For this reason, an evolution equivalent to 70 peak periods has been considered. According to laboratory experiments this is sufficient to ensure the full development of modulational instability, which is the main mechanisms responsible for the formation of rogue waves. A brief comment highlighting the different of our approach as compared with the one used in G. Ducrozet, F. Bonnefoy, D. Le Touzé, and P. Ferrant, "3-D HOS simulations of extreme waves in open seas", Nat. Haz. Earth Sys. Sci., 7, 109-122, 2007 is provided in the new version of the manuscript (reference is also added to the bibliography).

COMMENT BY THE REFEREE
Figures are small, and not easily readable. Is it possible to enlarge them? At least, the axis fonts should be enlarged.

ANSWER BY THE AUTHOR
We thank the referee for this comment. Fonts have been enlarged in the figures.

COMMENT BY THE REFEREE
Some of the references cited in the text did not appear in the reference list (Magnusson Donelan 2013, Bitner-Gregersen and Toffoli 2012, Krogstad et al. 2008)

ANSWER BY THE AUTHORS
We thank the referee for spotting this mistake. Reference list has been amended by adding

- Magnusson, A.K., and Donelan, M.A. (2013). The Andrea wave. characteristics of a measured North Sea rogue wave. JOMAE 2013, J_ID: OMAE DOI: 10.1115/1.4023800 1-March-13.
- Bitner-Gregersen, E. M. and Toffoli, A. (2012). On probability of occurrence of rogue waves. Natural Hazards and Earth System Sciences, 12, 751–762, 2012, doi:10.5194/nhess-12-751-2012.
- Krogstad H.E., S.F. Barstow, L.P. Mathiesen, L. Lønseth, A.K. Magnusson, M.A. Donelan, 2008: Extreme waves in the long-term wave Measurements at Ekofisk. Proceedings of the Rogue Waves 2008 Workshop, *Ed. M. Olagnon and M. Prevosto, October 13-15, 2008, pp. 23 – 33, Brest, France.*

COMMENT BY THE REFEREE

In section 2, is 'a low' referring to a low pressure cell?

ANSWER BY THE AUTHORS

Yes, we refer to low-pressure cells. We have amended this by additing the term "pressure" in Section 2, Line 24.