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Interactive Comment

Interactive comment on "Bayesian trend analysis of extreme wind using observed and hindcast series off Catalan coast, NW Mediterranean Sea" *by* M. I. Ortego et al.

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We answer the interesting comments made by reviewer number one, at the same time that we try to incorporate some of these suggestions into the manuscript. We thank Reviewer for his/her detailed reading and report.

A) I think that the use of non-overlapping data is a limitation in this study. How can be known if the differences between hindcast and observations are due to the source of the data rather than to the period of observation?. I think that the authors could find *other datasets covering the same period. For instance , Puertos del Estado or the XIOM network have longer time series in this region. Moreover, there are several other wave products readily available and covering until present (e.g. the WANA database from Puertos del Estado). Furthermore, the methodology could be tested with wind data over land, which is more easily accessible. With overlapping data the same experiment run in this study could be done discarding part of the records. Then, the results could be validated using the whole record. Additionally, the buoy record is short and this can affect the reliability of the parameter fitting. You could compare the results of the fitting of HIPOCAS data when using a short record instead of the long record in order to see if up to which extent this may affect the reliability of the results.*

Certainly, there are longer datasets where the hincast and the recorded data overlap for one ore more time intervals. This dataset was selected because there where no overlapping time intervals. In a previous work Ortego et al. (2012) two overlapping data series of waveheight (HIPOCAS and Tortosa Buoy) were analysed, with a model that dealt with this overlapping and with some gaps in the records. Attending the referee's suggestion we can apply our methodology to longer land wind series in future works.

B) I miss a discussion on the contribution of this paper related to other existing works and the authors could highlight the improvement brought by this new methodology. Also, the authors do not discuss the implications of their assumptions in the methodology.

We will try to select some references to enrich the exposition.

Minor comments

Wind data. I think that the HIPOCAS database does not provide 10 minute average wind speed but hourly data. Are the buoy data homogenized to the same frequency sampling than HIPOCAS? Also, how the gaps in the data affect the results?

HIPOCAS database provides hourly average of wind speed at 10m height. A sentence clarifying this aspect will be included in the manuscript. Gaps in the data series are properly addressed in the models proposed. Gaps represent a loss of information but do not represent an inconvenient for the methodology. However, we are not considering the distribution of events within a year and gaps covering only one season may cause small increments/decrements of the number of events or a distortion on their magnitude. A comment in this sense will be included in the manuscript.

P.804 L10-15. It will be illustrative to show the histogram of the data together with the GPD in order to see the suitability of this function to the data.

Figures QQplot-Buoy-param-all.pdf and QQplot-Hipocas-param-all.pdf show the QQ-plots of the Buoy/hipocas data using the GPD with median values of ξ and β as reference. This approach is quite restrictive because the GPD parameters are assumed uncertain and possibly changing in time. The conclusion is that GPD is a suitable model for both data series. These figures will be added to the paper.

P.808 L13-14 "we adopt here the latter parametrisation". Which one?

We adopt here the parametrisation in Ortego et al. (2012). We use

$$\mu = \log(y_{sup}) = \log(-\beta/\xi) \ , \ \nu = \log(-\xi) \ ,$$

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instead of the classical parameters ξ, β, given that the GPD distribution is in the Weibull d.a. ($\xi < 0$).

P809. L8-11 Under which criterium do you define the "compatibility"?

We are going to change the term *compatibility* by a sentence like "after taking logarithms the both series are likely to correspond to the Weibull domain of attraction." Posterior probabilities of Weibull domain were given in the paper (Table 1).

P812. L15 The definition of non-significative seems a bit arbitrary. How do you define significance? You could provide up to which confidence level you consider it is nonsignificant (e.g. it is non-significant at the 80% level). Also, the changes in σ_ν are non-significant at a similar level, so the sentence should go in the same sense and not suggesting that there are differences. In summary, the point is that it can't be said that there are or there are not differences among series.

Referee refers to σ_ν instead of α_ν, possibly due to the typography.

The joint pdf of Figure 4 has a large dispersion, and therefore conclusions should be taken carefully. Conclusions for both parameters are similar: there is a trend /difference between Hipocas and Buoy but they should be considered carefully as they are non-significative. As we are using Bayesian methods, a criterion based on Bayesian discrepancy p-value has been used: for each sample of posterior parameters, the corresponding trend or difference value is computed. These values are compared to the null values representing no-trend or no-difference. If the proportion of samples over the null is around 50%, there is no discrepancy between the hypothesis of null trend/difference and data (and therefore the coefficient is non-significant). If the proportion is either small ($< 2.5\%$ or large ($97.5 > \%$), there is a discrepancy between

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the null hypothesis and data. Therefore the coefficient we say that the parameter is significantly non-null Gelman et al. (1996). Some sentences will be included to clarify the concept of Bayesian p-value.

Additionally, looking at Fig. 2 it seems that there is some inconsistency. Fig. 2 clearly shows a decrease in the extreme events during the Buoy period. Isn't this contradictory with the fact of having positive σ_ν ? Maybe I misunderstood the meaning of the different parameters, in which case I think that it could help to the non-expert reader to discuss the results in terms of physical meaning. What does these results mean in terms of extreme events characteristics (intensity, frequency, length . . .).

Referee refers to σ_ν instead of α_ν, possibly due to the typography.

The fact of having positive trend parameter in ν, positive α_ν, is perfectly compatible with the decrease in the extreme events during the buoy period. For ν parameter, $\nu = \log(-\xi)$, we are considering a trend α_ν and a difference among HIPOCAS/Buoy series (δ_ν). Trend is positive (but not significant) and difference is negative (but non significative). Altogether this leads to smaller values of ν for the buoy period. In the classical parameterization this would mean a smaller ξ parameter. If the corresponding β classical parameters were the same for HIPOCAS and Buoy periods, this would lead to a lower upper limit of the GPD distribution for buoy period than for HIPOCAS.

For the upper limit parameter μ, only a difference between HIPOCAS and buoy periods has been considered and the parameter δ_μ describes this difference. A figure showing a kernel estimate of the density of the upper limit for HIPOCAS and Buoy will be added (upperlimitKDE-limit-ms.pdf).

P813 L24-28. This is speculative. The model is not run in a daily basis but at much higher frequency. The daily averaging is a post-process, so there is no indication that the model has stronger inertia. This links with my first comment, are the buoy data *averaged to produce the same variable (i.e. daily averaged winds) that the hindcast data? Also, having more inertia does not mean to have more energy. These results could be easily confirmed using overlapped data.*

Some sentences will be included to clarify the comment. However, the fact is that, actually, model data (being hourly averages) must exhibit less variability, i.e. have more "inertia" (in a figurative sense), than buoy data (10min averages). On the other hand, the lack of overlap between buoy and hindcast series is not a major problem for this methodology: as shown by Ortego et al. (2012), the Bayesian estimation procedure makes not necessary to have overlapping series, though of course the obtained estimates show quite less uncertainty if the series are the largest, and better if they overlap.

P814. L4. You have analysed a single time series from REMO, not the dataset.

The sentence will be rephrased. "A wind speed time series (REMO) has been analysed".

P814. L5. "In front of the Tarragona coast"

The sentence will be rephrased.

Fig. 1. Enlarge the circle and the cross

Done. Figure has been modified.

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References

Gelman, A., X. L. Meng, and H. Stern (1996). Posterior predictive assessment of model fitness via realized discrepancies (with discussion). *Statistica Sinica 6*, 733–807.

Ortego, M. I., R. Tolosana-Delgado, J. Gibergans-Báguena, J. J. Egozcue, and A. Sánchez-Arcilla (2012). Assessing wavestorm hazard evolution in the NW Mediterranean with hindcast and buoy data. *Climatic Change 113*, 713–731.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 799, 2014.

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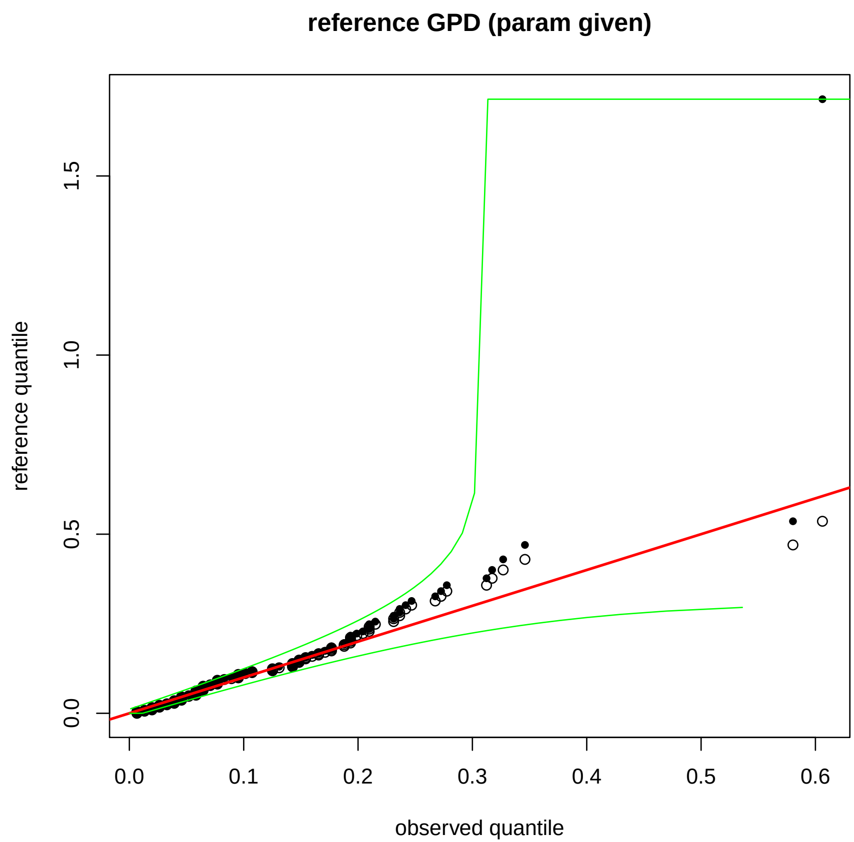

Fig. 1.

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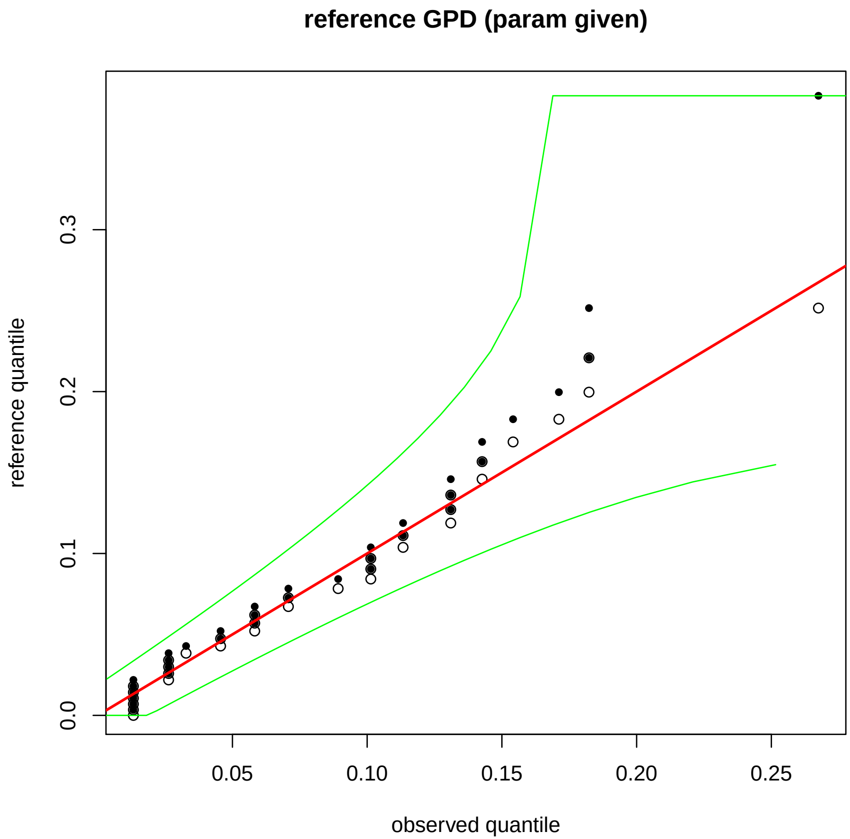

Fig. 2.

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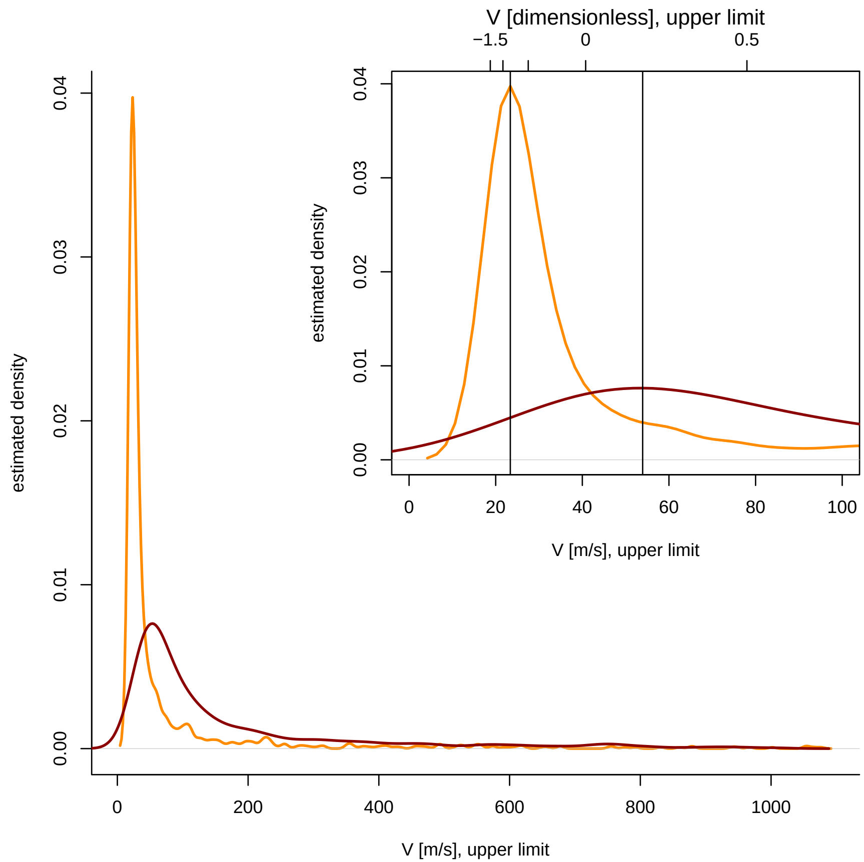

Fig. 3.

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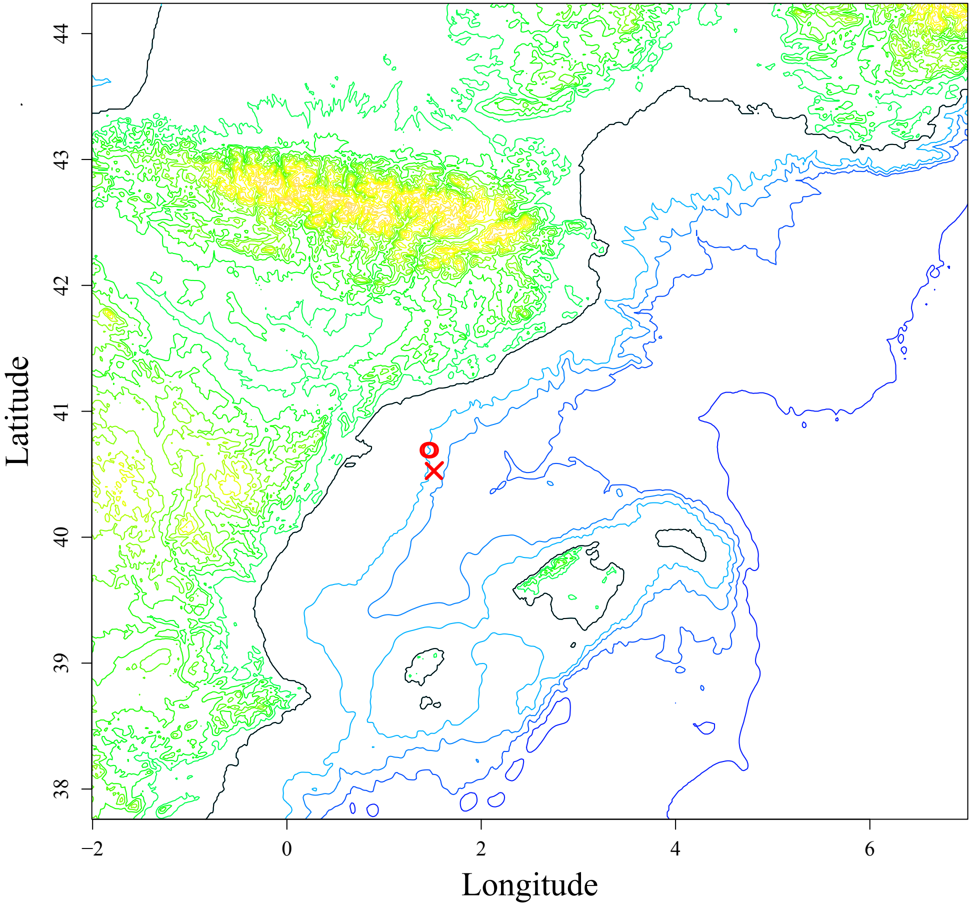

Fig. 4.

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