Natural Hazards
and Earth System
Sciences
Discussions

Interactive comment on "A nonstationary analysis for investigating the multiscale variability of extreme surges: case of the English Channel coasts" *by* Imen Turki et al.

Anonymous Referee #1

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Review on the paper "A nonstationary analysis for investigating the multiscale variability of extreme surges: case of the English Channel coasts"

General comments

In the research manuscript, the authors present an analysis of time series of storm surges in five stations along the coast of the English Channel.

The study is two-fold : a first part is related to the analysis of the monthly extreme storm-surges signals, by using a multi-scale wavelet analysis in order to describe the

Specific comments

2. Data

It no very clear in the paper if storm surge or the sea level height data is used. Only the later is measured by the tide gauge, and thus a pre-processing step is required to filter out the tides and the sea-level rise. The description of this pre-processing seems to be missing in the paper. Another question is about the availability of the large-scale atmospheric circulations indices (NAO, AMO...) during the whole period covered by the tide gauges. In particular, the Brest station has measurements from 1850, so one could wonder if the indices are available from the date, and what could be the quality of such values. I think that the paper could benefit from some discussion on this point.

3. Extreme value models

The authors use the classical extreme value distribution (GEV) to model the monthly maxima of storm surges, making the distribution non-stationary by incorporating climate indices as covariates.

Although the presentation of the model is rather clear, the data on with the model is applied is not as clear to me: is it on the initial time series of storm surges or on the spectral components? On L200, it seems that the model is applied to each spectral component, but the justification of using a GEV distribution is then questionable since the component by itself is not extreme nor a maxima, and thus an extreme value distribution is not justified. Marginal distributions of the variable on which the GEV is fitted could give some insight on the adequacy of a GEV, in addition to the QQ plots of Figure 10.

I have another remark about model selection: the authors do not show the fitted parameters values nor the associated confidence intervals, but only the AIC values in Table 3. Such values would be necessary to address the fit and to discuss whether or not the influences of the indices are significant. The authors are only selecting the parameter that cannot be considered are stationary, but not the index that is relevant to explain the non-stationary.

4. Multi-timescale variability of extreme surges

The authors describe the results of the continuous wavelet transform (CWT) on the monthly maxima of storm surges to assess the non-stationary behaviour

5. Large-scale climate North-Atlantic oscillations and their link to extreme surges in the English Channel

This section is two-fold : first, exhibit the link between the indices and the monthly maxima of storm surges and fit the GEV distribution to the components of the storm surge. The authors look at the wavelet coherence to address this question and conclude that :

> Each timescale exhibits mainly strong links with its associated climate index (L313)

Such a conclusion seems rather obvious to me because the indices are constructed that way and is not sufficient to my point of view to do variable selection in the GEV model of the following section before fitting the model.

Although the lengthy discussion about the visual inspection is interesting and may worth it, a proper statistical method to select the variable should be preferred.

Once the model is fitted, the paper falls short : since there is no variable selection and no use of the fitted model, what is the fit used for? We only can see with some difficulties the return levels of each component for the Brest station, but with little extrapolation. As is, the relevance of using a GEV model is questionable.

Technical remarks

- Spacing is not uniform in the text, please consider proof-reading; - Parameters values are missing in Table 3; - a Âű on L805; - Brest is missing in Figure 1; On L150: *The observations which correspond to the hydrographic zero level are referenced to zero tide gauge (Figure 1)* but seems missing; - Figures 2-3-5-6-7-8 : the time-scales can hardly be seen, please choose another color or another representation or another

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colormap. - Figure 2 color bar is not coherent with the other Figures; - Figures 4 and 9: the x-axis is not clear, at least 4-digit years should be provided. - Figure 10 a : The y-axis should be "Modeled values"; - Figure 10 b: the figure can hardly be read, please provide a larger version or a better quality (e.g. SVG)