

February 16, 2018

Re: Resubmission of manuscript "Analysis of the risk associated to coastal flooding hazards: A new historical extreme storm surges dataset for Dunkirk, France", nhes-2017-417

Copernicus Publications
Editorial Support

Dear Editor,

Thank you for the opportunity to revise our manuscript, "Analysis of the risk associated to coastal flooding hazards: A new historical extreme storm surges dataset for Dunkirk, France". We appreciate the careful review and constructive suggestions. It is our belief that the manuscript is substantially improved after making the suggested edits.

Following this letter are the reviewers comments with our responses, including how and where the text was modified. As suggested by the reviewers, our manuscript had been checked by a professional English editing service. The revision has been developed in consultation with all coauthors, and each author has given approval to the final form of this revision.

Thank you for your consideration.

Sincerely,

Yasser Hamdi

Point-by-Point response / reviewer # 1

Yasser Hamdi

General comments

Comments	Responses to comments
<p>It is well known that deriving water levels for large return periods using limited duration of observation can result in very significant errors. In this paper, the authors attempted to address this issue for the city of Dunkirk through the collection of long-term historical data. Although this approach is not really a first of its kind, it is still extremely interesting and valuable, and as such, it could be considered favorably for publication, provided that the authors address the two main concerns (and minor issues, see below) that I have regarding this paper:</p> <ol style="list-style-type: none"> 1. The authors state in the abstract that the aim is to demonstrate the technical feasibility of including long-term historical information to improve the statistical assessment of extreme water level return periods. But what is really a technically challenging when doing this? It is indeed challenging to find old HI, and the authors really deserve to be thanked for this valuable effort. But what is at least as challenging (in my opinion) is to answer this kind of questions: <ul style="list-style-type: none"> - to what extent are the storm surge dynamics that occurred hundreds of years ago representative of the actual level of risk? - has the bathymetry, topography, or land cover of the studied area evolved since then, and what could be the impact on storm surge dynamics? - how accurate are the historical water level data, considering, for example, potential sea level rise, land subsidence, uncertainties relative to the distinction between overflowing and overtopping when assessing maximum water levels, etc? <p>Answering these questions could be extremely difficult, but I think that the authors should at least discuss them in the paper.</p>	<p>What is really a technically challenging is :</p> <ul style="list-style-type: none"> - Find the right source of information, cross with other sources (to find the same information elsewhere and if the event is described in the same way or not). It is then necessary to quantify the information (estimate the value of the storm surge from qualitative information and quantitative information about other physical quantities that can lead to the estimation of storm surges - There are several types of historical data (range, exact value, lower bound, threshold of perception). Transform the historical information to these different types is not always easy... - In the statistics, one must calculate the empirical probabilities of the historical data (which is not the same as the systematic ones), calculate a likelihood taking into account the heterogeneous data (the historical data) and assign an effective duration to the collected data which an important setting in the frequency model that will be used to estimate the high return levels ... - Ensuring the completeness of the information is a task that requires a remarkable effort especially by the historian
<p>2-This study (as others) relies on one extremely strong hypothesis: the maximum water level is supposed to be spatially homogeneous, not only in Dunkirk, but also for the nuclear plant in Gravelines, 20km away. To what extent can this assumption be considered realistic? For example, tide gauges generally do not capture the whole wave setup component of the surge, which can vary by a few dozens of centimeters between a harbor, and nearby beaches. They also generally poorly capture infragravity waves, which have been observed in many places along the shoreline of France and can have huge impacts on coastal flooding. The bathymetry and topography can be also quite different in Dunkirk, and 20km away from the city. Considering the very high stakes, it is hence important I think to address these issues (or at least to discuss them) in the paper.</p>	<p>Indeed, the assumption is strong and the state of current practice is to neglect some local effects... Nevertheless, the spatial homogeneity assumption was not used arbitrarily in the present study (and in other studies dealing with the use of information in a regional context). Indeed, It was concluded in two regional frequency models (which were developed to estimate extreme storm surges in Dunkirk and other sites) that the Gravelines NPP is located in a physically (based the calculation of the extremal dependence coefficient) and statistically homogeneous region centered on the Dunkirk harbor.</p>

Specific Comments

Section	Comment	Response to reviewer	Response in the paper
Abstract & Introduction (§2)	Line 23: "Dunkirk site, representative of the Gravelines NPP": this statement should be tempered or discussed in greater details, as mentioned above.	All the studies about the Gravelines NPP use data from the Dunkirk harbor. Indeed, in the nuclear safety field, the representativeness of stations (for rainfall, discharges, sea levels, etc.) is being taken quite seriously. An in-depth study comparing sea levels (and storm surges) in Dunkerque and Gravelines (a short series) has been shown that the impact of the local effects is not significant.	A sentence (justifying the use of the Dunkirk harbor to analyze storm surges in Gravelines) was added in the 2nd § of the introduction.
1. the § before the last one	Lines 117-119: it is unclear whether or not you have already built a complete historical database for the entire French coasts (at least Atlantic and English Channel). Please reformulate.	This database is completed and is currently the subject of a working group involving several French organizations to share, complete and maintain it.	The sentence was reformulated.
2.2.2 Table 1 4.2 & 4.3 Tables 4-5	Table 1: please specify (when possible) where exactly the water and surge levels were obtained (at tide gauges? Dikes? in the streets? In houses? in areas exposed to waves or not?). It would be also interesting to know for each case to what extent the values could be affected or not by wave setup, wave run-up, or overtopping. If an area at a given altitude is flooded because of overtopping, it should not be treated the same way as if it was flooded by overflowing for example). Please do the same whenever possible for Tables 4-5.	Unfortunately, we do not have these details in the archives.	
3.1	Lines 267-268: "A POT threshold equal to 0,75m [...] is an adequate choice". Please give at least a few indications or a reference to explain how you came to choose this value.	OK	The 1st § in section 3.1 was modified.
4.3	Lines 445-446: this seems to suggest that some historical data (for the 18th century for example) have been collected but were not used in this paper. Why? If the purpose of this study is really to demonstrate the technical feasibility of a long-term historical study, then it is more important to describe this kind of information than computing new extreme water levels. On the other hand, if the objective is to do these computations, then all the available data have to be taken into account.	It is currently the subject of a second article that will be written by the historian and colleagues.	

2. Typographical-technical corrections

All minor corrections proposed by the reviewer were accepted and performed directly in the paper. The line by line review was considered as well.

Point-by-Point response / reviewer # 2

Yasser Hamdi

General comments

Comments	Responses to comments
The manuscript nness-2017-417 presents the reconstruction of the storm surge level in Dunkirk, utilizing data from different sources and dating back to the 16th century. It is a remarkable effort towards reconstructing the storm surge climate in Dunkirk and the detailed literature review provided is of invaluable significance.	Indeed, the effort to build the database is important (thanks to the historian with whom we worked).
The current form of the manuscript requires major revision since the syntax of the language is often problematic. The incoherent structure throughout the text and especially the description of the results, along with the poor quality of the presented results, makes it difficult for the reader to follow. The publication has the potential to be useful for future studies related with the impact of coastal floods, as soon as a proper justification of some technical approaches is provided.	<ul style="list-style-type: none"> - A major revision of English for errors (syntax, grammar, spelling and vocabulary) was made; - The structure and the quality of the presented results have been improved.

Specific Comments

Comment	Response to reviewer	Response in the paper
The description of the data needs to be improved – see also some recommendations at the next section. In section 4.3 the historical surge dataset is presented, but it is not clear whether the hydrodynamic component under study is the storm surge level or the total water level (including the contribution of other hydrodynamic components).	As it can be seen in the list of historical data obtained (Tables 1, 2, 6, 7), we seek to estimate the storm surges in the end. Total seal levels are also collected when available. Storm surges are then deducted from total levels by subtracting the predicted levels.	Sentence added to text in the 1st § of section 3.2.
Additionally, it is not clear how the surge level is estimated when only the meteorological conditions are available from the historical records.	Only when the tidal coefficient is given, using the approach described in §2 - section 3.3, one can estimate a value of the surge.	
While it is a fair assumption that during a storm event, the water level along neighbouring areas may exhibit a similar level, the local bathymetric features and the man-made structures may alter the local water level. Therefore these data should be considered only as qualitatively accurate and not quantitatively. Should these data be used, a comparison with numerical simulations would decrease the level of uncertainty.	Indeed, these data are considered qualitatively accurate and quantitatively uncertain. Although the distance between the places where information were collected and our point of interest (the target site: the Graveline NPP) is very small, the impact of certain local effects can creep in the inference. A relatively short series on the target site is used to compare the extreme levels at this site and Dunkirk. The comparison shows that in most cases the impact is not significant. Otherwise, the comparison with the simulations will make it possible to appreciate this uncertainty.	

Technical correction

Comment	Response to reviewer	Response in the paper
The MS should be proofread by a native English speaker for errors in syntax, grammar, spelling and vocabulary.	Ok.	
Informal expressions and language (e.g. “an important surge”, “horrible storm”) are used for the context of a scientific journal, while the terminology is not the most appropriate (e.g. “marine flooding”, “marine submersion”).	“marine flooding” and “marine submersion is replaced by “coastal flooding”.	“marine flooding” and “marine submersion is replaced by “coastal flooding”.
The manuscript lacks structure and is very difficult for the reader to follow, as the presentation of the data takes place together with the analysis. It is recommended first to describe the data that will be analyzed; this section should be followed by a short description of the methods and finally a section that presents the results after incorporating all the types of available data.	Structure reviewed.	The paper is restructured as proposed by the reviewer.
Although the POTH method has been described in previous publications, it is recommended to provide a short summary at the Methods section. This would give a better overview to the reader, regarding the analysis of the data and would enhance the clarity of the paper.	A general description of the POTH model and settings was provided in sections 4 and 4.3. Ok for further description.	A section 4.2 “The POTH frequency model” is added.
There is an abundance of information (the damage and the fatalities triggered by the storm, the weather description, etc) scattered around the essay that is loosely connected to the main argument. It would be helpful to move this to a supplementary material section; this would tidy up the main points and would make the argument read in a clearer way. For the same reason, measurements obtained from other sites may be omitted too from the main body of the manuscript, since they are not considered at the analysis (e.g. the section from line 206 to 213).	<ul style="list-style-type: none"> - The §s on the description of HI are moved to an appendix. - Description of the measurements which are not considered in the analysis (like the 1808 event) is removed from the main body of the manuscript to the appendix. 	Please see Appendix 1.
Please provide a map displaying all the places mentioned at the MS.	OK	Fig.1 updated.
Section 2 lacks structure, coherence and paragraph unity. The main title of the section as well as the ones of the following paragraphs are misleading and do not correspond to the topic of the paragraphs. Additionally, section 2.2.1 should be renumbered to 2.1.1 as it refers to the tide gauge record and not to the short-term HI.	Structure reviewed.	The paper is restructured as proposed by the reviewer.
The quality of the figures, the tables and their captions is poor and should be improved. Fig.6 does not provide any extra information to the reader.	Quality of figures and tables reviewed.	Fig. 6 removed; Fig. 4 & 5 improved and merged; Fig. 2 and 7 improved and merged.
Consider merging Tables 1, 2, 4 preferably presenting only the information related with the storm surge level and the data included in the analysis. All the information with respect to the sources, meteorological conditions etc should be provided in a tabular form at the supplementary material for future reference and for reproducing the analysis of this study.	Table 2 removed (merged with Table 1) Tables 5 and 6 merged	

Minor corrections Line by line review

All minor corrections proposed by the reviewer were accepted and performed directly in the paper. The line by line review was considered as well.