

Response to the reviews

For the Editor #Paolo Tarolli

The authors would like to thank the Professeur Paolo Tarolli for his valuable comments and suggestions, they will be seriously taking into consideration and corresponding corrections will be made in the next version of the manuscript. However, we present some clarification and answers (R) to his questions (Q) in the following text :

Q : Your article has been further revised by one reviewer who suggested minor changes. However, it seems that you did not reply (nor enriched the text) to the point I raised: I stressed the fact that the article should contain more mentions on hazards (the word "hazard" is just mentioned in the references), in order to meet the NHESS journal scope, otherwise the work will remain closed to a pure geology/geomorphology journal rather than our journal. Please enrich the text, both on the introduction and discussion part, with more mentions on hazards and possible advances of this research in coastal risk management.

R: Thank you very much again for your comment. We have considered your comments and, we have formulated the abstract, the introduction, and we add sentences in the discussion as following :

The abstract :

-and identify two sediment layers that are in connection with two major historical marine submersion events. The first layer is mentioned as E1 and seems to fit with the great tsunami of 365 Cal AD. This event was marked by an increase in the coarse sediment and it is correlated for the first time with the immersed city of Neapolis in northern Gulf of Hammamet in 2017 by the same tsunamis of 365 Cal AD. The other sandy layer referred to as E2 was dated from 1690 to 1760 Cal AD, and is marked by one specific sedimentological layer attributed to a marine submersion event. This layer could be associated with the 1693 tsunami event in southern Italy or an increase in extreme storm events.

The Introduction:

Add a new sentence (ligne 33): During the last century, coastal communities have become very vulnerable to many extreme events such as tsunamis, tropical storms, hurricanes, and floods (Chaumillon et al., 2017). Risks and vulnerabilities of the coastal area have recently increased, not only because of the sea-level rise the changes in climate conditions but also because of the high number of natural catastrophes disasters, and the construction of nonplanned urban areas (Cardona A., 2001; Milanés Batista et al., 2017).

-Add a new paragraph (from ligne 56): The Tunisian coast has been exposed to numerous extreme hazards (floods, storms, and tsunamis) (Rizzi et al., 2016; Zaïbi et al., 2016; Affouri et al., 2017; Khadraoui et al., 2018; Amrouni et al., 2019). During the last century, this coastal area has experienced some coastal marine storms (Zaïbi et al., 2016). Moreover, this area is also subject to tsunami events, which can especially come from the seismic source related to the tectonic activities in Southeastern Sicily e.g the immersed city of Neapolis in northern Gulf of Hammamet in 2017 suggest the occurrence of a tsunami in 365 AD (Aounallah and Fantar, 2006; National Heritage Institute of Tunisia, 2017).

- Add a new paragraph:(Morton et al., 2007; Dezileau et al., 2011; Sabatier et al., 2012). This geological approach using sedimentological and geochemical analyses has been used in the French, Morocco, and Spanish coasts (Degeai et al., 2015; Dezileau et al., 2016; Khalfaoui et al., 2019) . Inversely, only a few high-resolutions studies have been conducted on the Tunisian coast.

- Add a new sentence :In this context, the present study aims to reconstruct past marine submersion events from geological archives (cores) collected from the Ghar el Melh lagoon (NE of Tunisia) using a high-resolution sedimentological and geochemical analysis.

Discussion

Add a new paragraph as following:

-In this respect, the lagoonal deposit of Ghar el Melh can provide valuable information on these aspects of the past and subsequently provide a forecast about the future. So we can suggest that the Tunisian coast is very sensitive to extreme events, especially these coastal areas are vital for Tunisia's tourism development and economy. These hazard events can expose in the future many destructions and caused significant human and economic losses. In

this fact, many managements to risk should be taken into consideration and applied by the governorate. In this fact, many managements to risk in this coastal zone should be taken into consideration and applied by the governorate. A Regional Risk Assessment methodology must be developed for the assessment of the potential impacts of climate change in the Tunisian coastal zone of the Ghar El Melh lagoon.

For the Referee #Anonymous Referee 2

The authors would like to thank Anonymous Referee #2 for his valuable comments and suggestions, they will be seriously taking into consideration and corresponding corrections will be made in the next version of the manuscript. However, we present some clarification and answers (R) to his questions (Q) in the following text:

Q: The revised manuscript “Extreme marine events revealed by lagoonal sedimentary records in Ghar el Melh during the last 2500 years in the northeast of Tunisia” by Balkis Samah Kohila and colleagues is better than the previous version. I particularly appreciate the use of PCAs.

To go further, I would suggest the use of cluster analyses (cluster analysis, neighbor joining analysis) to test the statistical link between all the elements and the deposits. This must be done using both sedimentological data and XRF data. All data should be transformed into z-scores to avoid any bias due to the different scales of measurement. This would strengthen the outcomes and make the manuscript more robust.

R: Thank you very much again for your comment.

A cluster analyses of surface sediments was done (Figure 7B) and the data (ppm and %) was transformed into z-scores.

-Add a new paragraph as following:

4.1 Characterization of different detrital surface sources

To make our interpretations more vigorous, a tree diagram was generated using the statistical program XLSTAT 2021 statistical software, which is used as an additional tool to identify and test the statistical link between all the elements and the deposits using both sedimentological data and XRF data of surface sediments in the study area (Figure 7B). In the first cluster, the association of coarse fraction (Sand) with the Si is clear, suggesting that the silicone is coming from coarse marine sand inputs. However, the second cluster determines an assembly between the terrigenous elements (Ti, Fe, Sr, and Ca) and fine fractions (Silt and Sand). This difference in the origin of the terrigenous inputs in Ghar el Melh lagoon explained by the fact that, during floods events, finer sediments are coming from the Medejerda watershed whereas, at the time of marine storms, coarse marine sand inputs are from the barrier.