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Climate of the Past Discussions

Interactive comment on "Extreme flood events reconstruction during the last century in the El Bibane lagoon (Southeast of Tunisia): A Multi-proxy Approach" *by* A. Affouri et al.

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Responses to Reviewer Comments

We thank the reviewer for his thoughtful comments and suggestions. His comments have improved the manuscript considerably. We have included almost all of the raised suggestions and below we present a point-by-point response to the comments.

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Anonymous Referee #3 Received and published: 4 June 2016

The present paper by Affouri et al. deals with the identification of extreme events in the El Bibane lagoon (SE Tunisia) based mainly on the sediment geochemical composition. The paper itself illustrates an interesting method for identifying the catastrophic events in the sediment records in lagoon settings. The study of lagoon recent sediments and its comparison with sediment series from core shows a high potential of application in the study of past flood activity. However, the result presentation and discussion need, in my opinion, to be improved before publication.

Main comments:

1) The manuscript is mainly "descriptive", focused on the work carried out at this site, but a discussion about a possible application for identification of major floods events in the past is nearly absent. It is limited to a sentence in the Conclusions; this aspect deserves to be developed in the Introduction and Discussion. In particular, it would be useful to stress on the importance of lagoon sediment series for reconstructing the flood activity in arid and semi-arid environment, since no other significant (and continuous) sediment series can be easily retrieved in fluvial valleys. The reconstitution of fluvial hydrology is essential for climate modelling.

We agree with the reviewer. A paragraph was added in the introduction and in the discussion sections which deal with the importance of lagoon sediments for reconstructing the past flood activity in arid and semi-arid environments:

"Few studies have been undertaken to reconstruct past flood events from lagoon sediments (Raji, 2014). Most of the studies were interested to flooding associated with both hurricanes and tsunamis where overwash deposits preserved within back-barrier lagoons and salt ponds can provide a mean for documenting previous flooding activity. Heavy rain flooding events recorded within these lagoon environments are still poorly documented. Moreover, reconstruction of past flood events from sedimentary archives has been poorly studied in Tunisia. Zielhofer et al. (2014) have used fluvial archives

to reconstruct past fluvial activity in the northern part of Tunisia. However, these sedimentary sequences are often neither continuous nor complete. In our study we tried to reveal the importance of lagoonal archives to reconstruct past flood activities under a semi-arid environment in southern part of Tunisia, an area where significant sedimentary sequences are absent or not continuous in time.

2) The organization of the text should be revised (see minor remarks below)

In the revised version we take into account this suggestion. The organization of the text has been revised.

3) The use of trace elements is unclear for the Fe content (5.1.2). It is reported that Fe is "totally absent in marine sediments", but looking at Table 2, the sediments with no Fe are defined "beach". It is not the same; this should be clarified in the text. In addition, the authors should explain the total absence of Fe. Intuitively, it might be related to the beach sand composition (quartz and carbonate debris?), but it needs further explanation in the text.

Indeed, macroscopic observation of marine sediments revealed that they are composed mainly of quartz grain and shell debris. Fe is associated with clay minerals. These clay minerals are absent in the marine samples. The finer fraction (clay + silt) is minor in these samples because marine waves and currents are strong along the coast. This material is redistributed far away from the littoral. Such characteristics have been observed in other littoral environments (Sabatier, 2008; Raji, 2014).

4) The age model is problematic (5.3). Any possibility that the peak that is interpreted corresponding to the maximum of nuclear essays (1963) matches in reality the Chernobyl nuclear accident? The gap between 20 and 40 cm does not help interpreting correctly. Would it be possible to generate some more measurements?

The Chernobyl nuclear accident has not affected the Southern part of Tunisia and probably the northern part. Therefore, the increase in 137Cs in our sediment core was

associated to 1963.

5) I strongly recommend integrating in the core description the sedimentary structures, if visible, the nature of contacts between different layers (abrupt, gradual, etc.), and the degree of bioturbation. This would allow extending the discussion, taking in count the sedimentary processes at the origin of the coarse-grained layer. The core photo in figure 9 is useless, too small and low resolution. This figure would be much clearer if it includes: a) the granulometric profile and b) any sedimentary structure observed.

We are fully agree with the reviewer's suggestion. This photo was taken at low resolution. In order to improve this figure we added the granulometric profiles and retraced the stratigraphic log.

Minor remarks

1) Figures 1, 2 and 4: too many. I would suggest to reduce, combining the three in one or two (maximum) figures

As suggested by the reviewer, in the revised version we have combined these figures (1, 2 and 4) as Figure 1

2) Section 4.1: in which year the core has been retrieved?

The core has been retrieved in May, 2012.

3) Section 4.2.1: change "geochemically" in "geochemical"

In the revised version we change "geochemically" in "geochemical".

4) Section 4.2.1: there is an inconsistency between the XRF scanner resolution given in the methods (1 cm) and the data represented in figure 13 (rather 5 cm?)

XRF scanner resolution was performed each 2 cm (see table 3 and figure)

5) Section 4.2.1: define the granulometric classes (in μm) that are represented in figure 6 and 13

We agree with the reviewer's. We define here granulometric classes in μm.

6) Section 4.2.2: what type of software has been used for the Statistical Analysis?

We used the software STATITCF (1987) (see section 4.2.3)

7) Page 8, lines 9-13: it is surprising that eolian sand grains are angular, is that right? Usually, eolian sands are rather rounded;

The macroscopic observation of our aeolian samples show that they are composed of homogenous dark yellow sand with angular grains; some of them are coated by iron oxide. The quartz grains from the S17 and S18 samples showed angular quartz which could be related to mechanisms of particles transport (proximal vs distal from the source).

8) The pictures in figure 5 are hard to see, the label for S18 is missing on the picture and a micrometric scale is missing for all of them. I would suggest removing the panoramic pictures, leaving and enlarging the pictures showing the microfabric. Important: add a microscale!

As suggested by the reviewer 3, a microscale has been added on the figure.

9) Figure 5: the S3 seems to be heterogeneous, plurimodal sand. It does not match the particle size distribution shown in figure 6. You should check if the photo really corresponds to the right sample.

Indeed, there is a difference between the sedimentary material S3 (Fig. 4) and the grain size distribution (Fig. 5). We explain this difference by the fact that the binocular observation was performed on raw samples whereas Laser Grain size analysis was performed on fraction < 1.5 mm. The fraction >1.5 mm is composed mainly of shell debris which were eliminated by sieving at 1.5 mm before Laser Grain size analysis.

10) The section 6.1 should not go in the Discussion, but in the Results

In the revised version we take into account this suggestion:

The section 6.1 was displaced in the Result section (see section 5.1.3)

11) Section 6.3: add references to figures

As suggested by the reviewer we added a reference to figures.

12) Figure 13 seems to be incomplete (FL1 is not shaded)

We thank the reviewer for his remark. FL1 has been added in the Figure 13.

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