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Interactive comment on "Extreme storms during the last 6,500 years from lagoonal sedimentary archives in Mar Menor (SE SPAIN)" *by* L. Dezileau et al.

L. Dezileau et al.

dezileau@gm.univ-montp2.fr

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Reviewer #2: S. Kortekaas: Specific comments:

- Section 1-Introduction: You mention that historic tsunamis from the Algerian coast have been modelled (l.67-68). Do these models show possible flooding of the Mar Menor area by these events ?

In this article (Alvarez-Gomez et al., 2010), a set of 22 seismic tsunamigenic sources has been used to estimate the tsunami threat over the Spanish Mediterranean coast of the Iberian peninsula and the Balearic Islands. Maximum wave elevation maps and tsunami travel times have been computed by means of numerical modelling and they

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have obtained estimations of threat levels for each source over the Spanish coast. In the worst case, a maximum wave elevation of 1 m is estimated off the coast of Torejevia (near the suty site).

- Section 3-Material and methods: What exactly is a simplified piston corer ? We collected our sediment core using an UWITEC hammer action corer. The lower part of the corer was equipped by an orange peel core catcher (simplified version) and not by an hydaulic rubber sleeve.

- Section 4.2-Sediment source: As you have taken samples from the barrier, it would be good to present the results. Also add a discussion how these results compare to the grain-size distribution of the sand layers in the core. Similar distribution, suggesting the sand in the cores originates from the barrier ?

We agree with the reviewer. A figure is added in section 4.2. This figure (figure 2b) shows that the percentages of the mean grain population ranging between 160 and 653 μm decrease from the barrier to the lagoon in surface samples.

- Section 4.3: Variations in taxon richness and species richness is discussed here. Maybe add information on variations in the number of specimens (total abundance)? Does this tell you anything ?

The number of specimens (total abundance) is included in figure 5. However it is not discussed in detail in the article because the total abundance and relative abundance among species is more related to lagoon productivity and contamination status while species richness is more related to sea-lagoon connectivity and marine influence, that is the main target of this article. Detailed faunal and assemblage analyses will be considered in another paper as in the present one would make it to complex for the purposes of the paper. A paragraph was added in the article: Macro-fauna analyses are a good indicator of a lagoon palaeo-isolation state. While total abundance and relative abundance of individuals of the different species is a good indicator of environmental stress and lagoon productivity, species richnes is a good indicator of marine influence

because species develop in different ranges of salinity, temperature and oxygenation and colonization of marine species into the lagoon environments depends of the isolation degree and connectivity between both systems (Pérez-Ruzafa and Marcos, 1992; Pérez-Ruzafa et al., 2005). Figure 5 shows the variation of the number of species and total abundance (number of individuals in 100 cm3) along the studied time series. Taxon richness ranges between 0, at depths higher than 365 cm, and 18 reached at a 260 cm depth. The impoverished depths, after the earlier azoic one, corresponds to 302-362 cm with a mean of 4.76 taxons, 72-78 cm with a mean of 5 taxons and 30-36 cm with a mean of 5.7 taxons. The depths with highest species richness are from 192 to 266 cm and from 81 to 186 cm. These depths would correspond to a higher marine influence. Above 150 cm takes place a progressive impoverishment in the number of species reflecting a progressive isolation of the Mar Menor from the Mediterranean Sea, with punctual peacks in species richness, probably related to episodes of rupture of the sandbar.

- Figure 6 + section 4.2: Figure 6 shows the abundance of 4 different species, but only 3 of them are discussed in the text. Could you add some information on Bittium reticulatum? Are all other species mentioned in line 211-216 irrelevant to the interpretation? As you have counted more than those 4 species, why not add a table or graph with all species counted, in percentage of total counts?

Yes, sure we could further exploit these data on malacofauna. However, given the theme of the article on the reconstruction of paleo-flooding events we have not exploited all these data. Here, we used only 3 different species some of which are rather associated with a marine environment (ex: Conus ventricosus) and others to an isolated lagoon environment (ex: Hydrobia acuta). Bittium Reticulatum is often associated to a marine influence (Sabatier et al., 2012). The aim was to show a change in the environmental context from a lagoonal environment, with a marine influence to a more isolated environment. This aspect is really important for paleo-flooding reconstructions.

- Section 5.2: In the discussion of past historical events it would help readers who are

less familiar with the topography of the area to give some more information on how these records relate to the site. E.g.: How far are the Torrevieja harbour and the cities of La Union and Cartagena, mentioned in the text, from the Mar Menor lagoon? Where is Zemmouri located? This could be a map or added text.

We agree with the reviewer. This has been added in the article. See Figure 1.

- Section 5.2, l. : 326-331: Alvarez-Gomez et al (2011) used numerical simulations to identified tsunami sources and the areas of maximum impact. Could you expand on this? Did they identify tsunami sources in the Western Mediterranean or only Algerian sources? Where did their study show the main impact areas? What source is associated with the mentioned max. wave height of 0.5-1 m?

In the Mediterranean area, Spain is exposed to two different tectonic environments with contrasting characteristics. On one hand, the Alboran Basin characterised by transcurrent and transpressive tectonics and, on the other hand, the North Algerian fold and thrust belt, characterised by compressive tectonics. In the article of Alvarez-Gomez et al., (2011), a set of 22 seismic tsunamigenic sources (from the Alboran basin and the North Algerian fold) has been used to estimate the tsunami threat over the Spanish Mediterranean coast of the Iberian peninsula and the Balearic Islands. Maximum wave elevation maps and tsunami travel times have been computed by means of numerical modelling and they have obtained estimations of threat levels for each source over the Spanish coast. The sources on the Western edge of North Algeria are the most dangerous, due to their threat to the South-Eastern coast of the Iberian Peninsula and to the Western Balearic Islands. In general, the Northern Algerian sources pose a greater risk to the Spanish coast than the Alboran Sea sources, which only threaten the peninsular coast. In the Iberian Peninsula, the Spanish provinces of Almeria and Murcia are the most exposed (the Maximum Wave Elevation was estimated between 0.5 and 1 m along this area), while all the Balearic Islands can be affected by the North Algerian sources with probable severe damage, specially the islands of Ibiza and Minorca (the Maximum Wave Elevation was estimated between 1m and 2m along this area). We did

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not add text on these aspects (Chapter 5.2). We think it is sufficiently detailed for the reader.

- Section 5.2, l. 338-343: If tsunamis are extremely rare and of low magnitude in this part of the Mediterranean and cannot have caused overwash of the Mar Menor lagoon barrier, could they have deposited those boulders on the Algerian coast? Add to the discussion that the age of the boulders does not correspond to any of the marine overwash events in the Mar Menor lagoon.

We agree with the reviewer. The text is modified:" Although no historical accounts report these events, tsunami events are extremely rare and mainly of low magnitude and cannot be at the origin of the different sand layers in the Mar Menor lagoon." And "In the core MM2, no sand layers are consistent with the Algerian tsunamis dated to around 419 AD and 1700 AD (Figure 8). There is evidence that this sand layer is compatible with large storm waves."

– Section 5.3, l. 357-360: I think a short discussion is needed on how hematite stained grains relate to temperature/climate.

The ice-rafted debris (IRD) indices in North Atlantic developed by Bond et al. (1997, 2001) is a well-known proxy that have revealed a millennial-scale climate variability during the Holocene. We think that a short discussion on this proxy is not necessary.

Technical corrections: - Check capitals Figure/figure Done - Section 2-Study site: There are quite some location names in the text of the paper that are not shown in figure 1 - Figure 1: I know the coordinates on the side of the figures give the scale, but I would suggest adding a scale bar as well. Done

- Section 3.5, l. 147: Several methods are two methods, I think. Done

- Section 4.2, l. 171: Terrigenous fraction –Do you mean the sediment input in the lagoon is controlled by two sources terrestrial (from rivers) and marine (overwash events)? Yes

- Figure 5: Needs a little more information in the caption: What are the different colours (brown, blue, yellow), the grey bands. The text states (section 3.3 l.132-133): “species richness (S), taxon abundance (ni) and total abundance (N). The caption in figure 5 says it shows taxon and species richness and the legend shows S and N, indicating species richness and total abundance. Should this be S and ni? Or should the caption read species richness and total abundance? Please also indicate in the caption what scale corresponds to what curve. These informations are added in figure 5.

- There are two section 4.3, please correct numbering. Done

- Figure 6: Add a comment about the very different scales of each graph. Also, can you please explain what the numbers in the scale mean? How many specimens were counted? Would it be more informative to show scales in percentage of total counts? Macro-fauna samples were taken at fixed volume (100 cm3). This information is added in figure 6.

- Figure 7: According to the figure caption there are 17 radio carbon dates, but in the curve there are 18 dates shown. The first point correspond to the 137Cs date (1963 AD)

Do I understand correctly that additional information on the other dating techniques used will be published in a separate paper? Yes

- Section 5.1, l. 280-181: Do you mean that the sand washed into the lagoon by storms/tsunamis did not reach as far into the lagoon as the location of the core, but may be found closer to the barrier? Yes

- Section 5.2, l. 301: Wave heights associated with this storm were higher than 8 m –is this in the lagoon? Wave heights associated with the 1869 storm were estimated higher than 8 m off the La Manga sandbar.

- Figure 8: The scale of the % hematite stained grains ranges from -10 to 10, which doesn’t seem to make sense -negative percent- ages? It is an indice (cf. Bond et al.

1997, 2001)

- In the second graph, please indicate which of the two species is indicated in red and which in black. Done

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/cp-2016-20/cp-2016-20-AC1-supplement.pdf

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