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Climate of the Past Discussions

Interactive comment on "Sea surface temperature variability in the central-western Mediterranean Sea during the last 2700 years: a multi-proxy and multi-record approach" *by* M. Cisneros et al.

Anonymous Referee #1

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General comments.

This study presents the past 2700-year records of G. bulloides Mg/Ca-SST and d18O as well as alkenone-SST from the cores collected at two stations in the north of Minorca. To reinforce Mg/Ca-SST reconstruction, G. bulloides Mg/Ca calibration was improved by adding core-top G. bulloides Mg/Ca data from the western Mediterranean Sea. By stacking the SST anomaly records and calculated surface water d18O records, changes in temperature and in the balance between evaporation and precipitation (E-P) were proposed over the last 2700 years.

I believe that the data have great interest to improve spatiotemporal coverage of

records for the last two millennia. As the authors stated, the amplitude of reconstructed variability for this timescale is close to the internal noise of records. I thus have several suggestions and questions on representativity of reconstructed signals and chronological constrains.

1. About sample heterogeneity and representativity of reconstructed signals The E-P balance was estimated by correcting temperature effect on G. bulloides d18O with Mg/Ca-SST obtained on the same organism. However, the samples for Mg/Ca and d18O measurements were separately prepared although it could be possible to crush, homogenise and mechanically clean test fragments before splitting for Mg/Ca and d18O analysis. Taking into account the small variability of signals, what would be the size of uncertainty related to sample heterogeneity? Since core MR3.1 was splitted into MR3.1A and MR3.1B, and the splitted samples were separately analyzed, scatter plot of G. bulloides Mg/Ca, d18O and calculated d18Osw obtained for MR3.1A and MR3.1B will allow evaluating such internal variability.

In relation to the above-mentioned point, it is not clear how core MR3.1A Mg/Ca data obtained with the reductive step were converted into SST values. This point should be added to the text, and again the scatter plot will provide information on cleaning effect and sample heterogeneity. Besides, the Mg/Ca decrease of 23% by the reductive step is quite large compared to the general offset of 8 to 10% (Barker et al., 2003; Yu et al., 2007). Indeed, Pena et al. (2005) reported a larger offset but the studied samples contain Mn carbonates with high Mg. What would be possible reasons for this strong cleaning effect observed for the Minorca samples?

Another way to evaluate the representativity of signals is to compare with Mg/Ca-SST and d18O of G. bulloides, estimated d18Osw and UK'37-SST already obtained for the Minorca site over the last 2000 years (Moreno et al., 2012).

These comparisons will allow estimating the size of significant variability. The authors may add the related uncertainty of reconstructed signals to the stack records. This will

help distinguishing robust variability from internal noise and reinforce the interpretation developed in discussion section.

2. About the chronological constrains using geochemical data The peaks of Mn XRF intensity of bulk sediments and of foraminiferal Mn/Ca (not cleaned with a reductive step) are expected to be almost synchronous because they both reflect redox state of pore water. In contrast, reductively cleaned planktonic foraminiferal Mn/Ca values were used as an indicator of seawater Mn concentration in water column where planktonic foraminifer calcified (Klinkhammer et al., 2009). Since foraminiferal Mn contents of core MR3.1A were obtained with a reductive cleaning, it is not obvious whether the synchronous peaks with Mn XRF intensity of bulk sediments are expected (Figure 6). It will be interesting to present the foraminiferal Mn concentration as Mn/Ca ratio (Fig. 6, figure caption and the text) since the value of this ratio would allow distinguishing pore water or seawater origin Mn. Another concern about the chronological constrains with geochemical data is difference of data resolution. The tie points shown in Figure 5 (Mg/Ca-SST) and Figure 6 (Mn) seem to be affected by temporal resolution of records. For instance MR3.1B foraminiferal Mn and bulk sediment XRF Mn peaks are not totally synchronous because of different resolution of the records (Fig. 6b). Since the initial age constrain was established by Bayesian models, I believe that the authors created the coherent age model. However, assessment of age uncertainty will be useful to avoid over-interpretation in the future studies.

The manuscript is generally well written but there exist a number of small grammatical errors and typos. A careful reading throughout the text will improve the quality of the text.

I recommend publish this work after minor revision.

Minor or specific comments.

Page 7, line 155. Cite “Fig. 1a” after “the Alboran Sea”.

Page 8, lines 193-196, about the split of core. If I understand well, only core MR3.1 was splitted into two halves (MR3.1A and MR3.1B), and the result of core “MR3.1” does not exist. Please revise the text to avoid confusion.

Page 10, line 229. The thickness of XRF foil should be 4 micrometer not “mm”.

Page 11, line 257, “blacks” should be “blanks”.

Page 14, lines 336-340, about the biostratigraphical constrain. It is necessary to add a short explanation why the peak of G. quadrilobatus and G. truncatulinoides (left coiling) are expected to be synchronous between Minorca site and southern Tyrrhenian Sea.

Page 20, line 482. “towns” should be replaced by “tows”.

Page 24, line 569. “(Fig. 10g)” should be “(Fig. 10e)”.

Page 26, lines 611-620. The larger amplitude of SST change with G. bulloides Mg/Ca relative to UK’37-SST was already reported by Moreno et al. (2012) for the Minorca site. This paper can be cited here.

Page 26, line 624. “apposite” should be “opposite”.

Page 28, line 678 to page 29, line 680. This sentence should be revised.

Page 31, line 732. “(Fig.11a, c)” should be “(Fig. 11a)”.

Page 31, line 754, “isotope variability” is unclear.

Page 33, lines 786-789. The relationship between negative NAO phases and cooling based on Mg/Ca-SST. This sentence will be revised because the relationship is not clearly visible in figure.

Page 33, lines 795-797 and Figure 13, about the relationship between d18Osw and NAO. The proposed correlation is not clear with Figure 13. If it is statistically significant, modification of d18Osw stack scale may be necessary.

Figure 6b. Right y-axis should be XRF data for “MR3.1B” not “MR3.2”.

Figure 7. The sample with the highest Mg/Ca value is offset from the general trend. Which core indicates this data point?

Figures 8 and 9 caption. “black plot” and “grey plot” should be exchanged.

Table 1. Indicate that Mg/Ca and d18Oc values are obtained for “G. bulloides” cleaned without a reductive step. The unit for d18O “(VPDB‰” should be added. If age control of each core-top is available, it is useful to show it. If not, at least indicate corer types in the text.

Table 2. Indicate that 14C ages were obtained on monospecific foraminifer G. inflata.

References Klinkhammer, G. P., Mix, A. C., and Haley, B. A.: Increased dissolved terrestrial input to the coastal ocean during the last deglaciation, Geochem. Geophys. Geosyst., 10, Q03009, 2009.

Interactive comment on Clim. Past Discuss., 11, 5439, 2015.