26/11/2021

Response letter to comments on *Hydroclimatic variability of opposing late Pleistocene climates in the Levant revealed by deep Dead Sea sediments* (CP-2020-161-R1), by Ben Dor and colleagues

Dear Editor,

We wish to thank you and the reviewer once more for completing the review of the revised manuscript. We are pleased to read that your overall impression of the manuscript is positive and that you will recommend the paper for publication following the suggested minor revision. We have read and corrected the manuscript in accordance with the comments in order to make sure that the revised paper meets the high standards of *Climate of the Past*. Please find below our detailed response to the comments made by the reviewers.

On behalf of all authors,

Dr. Yoav Ben Dor

Response to Comment by Prof. Pierre Francus (Editor)

Response to general comments:

Dear Prof. Pierre Francus,

We wish to thank you and the reviewers for completing this review in a timely manner and providing your comments on the revised text. We feel that your recent comments have indeed improved the readability of the paper and resulted in an improved and clear version of the paper.

On behalf of all authors,

Dr. Yoav Ben Dor

Response to specific comments:

Comment:

Dear authors,

Thank you very much for deeply revising your manuscript following the comments of the reviewers and mine. I acknowledge this was a major effort, and find the outcome is very positive. Yet, reviewer #3 still has some comments. I also read the manuscript again and made some suggestions for improvements. My comments are in the .PDF file in attachments. I think these comments can be easily addressed and should not take long to complete.

Therefore I'm happy to recommend your paper to be published subject to minor revisions.

Thank you very much again for submitting your work to Climate of the Past.

Best regards,

Pierre Francus

Response to technical corrections:

All technical corrections were corrected accordingly.

Response to Report #3

By Prof. Reik Donner

Response to general comments:

We appreciate Prof. Donner's willingness to review the manuscript after implementing his first review. We found his comments and very detailed revision very useful for finalizing the manuscript and improving its readability for the *Climate of the Past* readers. We have revised the text following his suggestions, and provide below the detailed responses to his comments.

Response to comments:

Comment 1: The unit prefix "kilo" is usually abbreviated by a small "k", not a capital letter. To cope with proper physical units, I recommend the authors to replace the used units "Ka" (for kiloyears) by "ka" throughout all the manuscript, including figures/captions (and also the supplementary material).

Response 1: Corrected.

Comment 2: Every now and then, the authors use the term "Mediterranean regions" (e.g. on lines 39, 45, 63, etc.). It is not clear to me whether they attempt to point to the Mediterranean region as a whole, or different regions of the Mediterranean and its surrounding. I recommend clarifying the wording accordingly.

Response 2: Corrected. The entire text was revised to make this point clear where relevant.

Comment 3: The authors frequently use the notion of periodicity, which appears not correct to me in the context of this work. Especially, on p.3, l.77, they refer to the "periodicity of known global teleconnection patterns" with particular emphasis to the NAO. I have to admit that I am not aware of any teleconnection pattern that is strictly periodic, and especially NAO is well known to lack periodic behavior. What the authors attempt to refer to are "cyclic" components and "preferred time scales", and I would expect to also stick to this precise terminology to the extent possible, given that the present work ultimately relies on using quite advanced statistical and complex systems concepts for the analysis of the considered records.

Response 3: Corrected.

Comment 4: Remark: It is quite usual to combine mathematical equations with captions, as done on pp.10,12. To me, the use of captions in the present cases appears reasonable, but might not be compatible with the requirements of the publisher.

Response 4: Although the addition of captions to the equations does not appear in the instructions to the authors, I could not find clear instructions forbidding the addition of captions

to the equations. Thus, because in our opinion those captions do facilitate the reading, I would suggest leaving them. However, if this will come up during the typesetting we can convert these into simple text.

Comment 5: While much of the description of the advanced analysis techniques appears technically correct, I struggle with the sentence on p.13, ll.311-312: "In cases where the RP consists of more single recurrence points than vertical structures LAM will decrease:" Better write: "…will take low values".

Response 5: Corrected.

Comment 6: Page 15, ll.375-376: Skewness is by definition a dimensionless statistical quantity and must not be accompanied with any physical unit.

Response 6: Corrected.

Comment 7: Table 2 does not seem to be referred to in the text.

Response 7: Corrected.

Comment 8: The caption of Table 3 refers to an Appendix B which does not exist (anymore).

Response 8: Corrected.

Comment 9: Related to #3: I don't quite like the subheading "Detecting periodic components" of Section 4.3 (erroneously listed as 4.2 on p.21), which in my opinion should be rather replaced by "Analysis of oscillatory components" or something similar.

The first sentence of the section refers to "periodic or oscillatory behaviors", which are two things that are pretty different – also many chaotic systems present well-defined oscillations but are far from being periodic. Better turn this sentence upside-down: "The appearance of short diagonal lines in the recurrence plot of the aragonite thickness series indicates either intermittent periodic or weakly to moderately chaotic behaviours." Page 22, l.445: better replace "power of periodicities of" by "spectral power in". Line 449: replace "these periodicities are attributed" by "the elevated spectral power in those frequency bands can be attributed". Similar in ll.451-452: "High spectral power in the centennial- to bicentennial band (~120-250 years) is observed…; ll.453-454: "A similar behavior is also identified…" For the rest of this section, the use of the term "periodic" appears fine, especially in reference to SSA, which indeed extracts exactly periodic components by definition. Similar comments apply to Section 5.2 (erroneously numbered as 5.3 on p.25).

Response 9: Corrected. The entire manuscript was also revised to accommodate these very helpful comments where relevant.

Comment 10: Also the terminology of the wavelet analyses (Fig. 8 and supplement) need to be sharpened: What the authors call "wavelet spectra" are "wavelet spectrograms" (spectra show only the dependence on scale or frequency, spectrograms the additional time-dependence).

Response 10: Corrected.

Comment 11: The definition of the coefficient of variation in the captions of Figs. 10 and 11 does not make any sense mathematically, since RC(1) is a time series – how do you divide a number (std) by a time series?

Response 11: This is now clarified in the revised version. It is the *running* standard deviation that is divided by $RC^{(1)}$, rather than the standard deviation of the entire series. The purpose of this plot is to demonstrate the "volatility" of the data, or its "running variability", which often increases together with increasing mean. Because the variance (or standard deviation) of a hydrologic time series commonly increases with increasing mean and vice versa, it is important to "normalize" the std by the mean, which provides a "standardized volatility" indicator. In this case this statistic was used as a running statistic instead as a "bulk" value. However, because we noted that the running mean of a time series often depicts shifts and therefore does not closely follow the series, we utilized the $RC^{(1)}$ of the SSA as a representative of the running mean.

Comment 12: Page 31: The data availability statement refers to some "appendices" which do not exist as such.

Response 12: Corrected.

Response to technical corrections:

All technical corrections were revised accordingly.

Suggested edits:

- P.1, l.14 "in situ" - *corrected*

- P.1, l.20: "focus on two series" - *corrected*

- P.1, l.27. "in situ" - *corrected*

- P.2, l.45: "in situ" - *corrected*

- P.2, l.58: "the eastern parts are substantially drier than its eastern parts" => I suppose that one of the two should be "western" - *corrected*

- P.5, l.92: “changes in Dead Sea level” - *corrected*

- P.5, l.100: “although” - *corrected*

- P.5, l.109: “spreads” - *corrected*

- P.5, l.118: “gradient” - *corrected*

- P.6, l.149: “The site 5017 cores” - *corrected*

- P.7, ll.156-157: “the ICDP coring site 5017” - *corrected*

- P.9, l.203: “these sediments and their mode of formation based on…” - *corrected*

- P.9, l.207: “changes of sediment properties” - *corrected*

- P.9, l.212: “intervals for Lake Lisan” - *corrected*

- P.10, l.250: Do you mean “false positive rate” or “error rate”? “False positive error” is not a proper statistical term. – *corrected into:* considered statistically significant at the α=0.05 confidence level

- P.14, l.330: “tools” - *corrected*

- P.14, l.335: “the alpha=0.05 confidence level” - *corrected*

- P.14, l.340: “principal components” - *corrected*

- P.15, l.362: “a clay cap and a thin lamina…” - *corrected*

- P.15, l.363: please explain the abbreviation “ERD” - *corrected*

- Figs. 6 and 7, captions: There are several typos – “blue rectangles”, “chaotic”, “diagonal lines”, “carried out” - *corrected*

- P.21, l.436: “4.2” should be “4.3” - *corrected*

- P.22, ll.446-447: “significant at an alpha=0.05 confidence level” - *corrected*

- P.24, l.482: “testifies its value” – *corrected into: demonstrates its*

- P.25, l.515: “5.3” should be “5.2.”; regarding the wording “periodic”, please see above

- P.25, l.521: “to identify” - *corrected*

- P.26, Fig. 9, caption: use \citet instead of \citep command for referring to Kolodny et al. - *corrected*

- P.26, l.546: remove “bear” - *corrected*

- P.27, l.566: “non-Poissonian” - *corrected*

- P.28, l.585: “resulting” - *corrected*

- P.29, l.602: What is Fig. “R1”? – *corrected. This was a figure submitted within the revision process, but is not part of the manuscript.*

- P.29, l.602: “which are found” - *corrected*

- P.29, l.614: start a new sentence at “The second cluster…” - *corrected*