Interactive comment on “The 4.2 ka event: multi-proxy records from a closed lake in the northern margin of the East Asian summer monsoon” by Jule Xiao et al.

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Response to the Referees of cp-2018-66
We first wish to express our gratitude to Prof. Raymond Bradley for the review of our manuscript. We think that most of the comments are helpful to improve the original manuscript. We respond to all the comments as follows.

Comments The paper reports on the analysis of a sediment core from Hulun Lake in NE China, focusing on the interval from 3000–5000 years B.P. The authors examine grain size, pollen, ostracods and conclude that there was a dry episode centered on 4230–3820 calendar years B.P., which they ascribe to a weaker summer monsoon. The paper begins with a 1–2 page preamble, which is very similar to the introduction to Xiao et al., 2018 in Quaternary International. I suggest that this section be significantly reduced—the paper could really begin somewhere around line 106.

Response Yes. We agree. The relevant paragraphs before the original line 106 have been re-organized and reduced in length by 23 lines. We think that it is necessary to give a brief review of the history of researches on abrupt climate changes during the Holocene. This review would help the readers understand the spatio-temporal complexity of the Holocene climate variability on millennial to centennial scales so as to contribute to the deepening and extending of the related studies in the future. See lines 62–83.

Comments The manuscript is in fact, a summation of research reported elsewhere, as studies of the ostracods, pollen and grain size have already been reported (Zhai et al., 2011, Wen et al., 2010 and Xiao et al., 2009, respectively) though here they focus on the mid to late Holocene section. I suggest that the Results section be shortened by eliminating the headers to sub-sections 4.1 to 4.4, & simply combining the results into one shorter paragraph.

Response Yes. We totally agree. We have done as you suggested. See lines 231–247.

Comments By the way, it’s too bad that you cut up the core in the field—it would have been better to have had a complete core to study using non-destructive methods first (e.g. scanning XRF) to obtain a much higher resolution record than your individual samples provided.
Response No. We don't think so. Scanning of the original core really can generate a
mm-scale resolution record, but the output data of both the element and mineral con-
tents are actually ambiguous because the datum is a mixture of signals derived from
both terrestrial and lacustrine materials in the case of faulted basin lakes like Hulun
Lake that have a large drainage area. Therefore the scanning data of sediment cores
can hardly be used to interpret the processes occurring within such lakes, although
these data provide a useful tool for connecting core sections recovered from different
sites of a lake. In the case of maar lakes that have a quite small catchment, nev-
ertheless, scanning of sediment cores may yield a valuable record of changes in the
lacustrine environment and the regional climate.

Comments Some specific issues: Add “B.P.” after 4.2 ka in Title and elsewhere in the
paper.

Response Yes. We did. See the Title and the related places in the text.

Comments Forget about the Bond cycle connection—it is non-existent (Figure 5) & has
no logical place in your argument. The connection to the Stott et al. SST reconstruction
is also weak, given the uncertainties in their reconstruction. You should be careful not
to over-interpret that record; it is interesting but hardly definitive. I don’t think Figure 5
is very useful at all.

Response No. We don't think so. This study is focused on the regional manifestation
of the 4.2 ka BP event and the associated mechanism. Therefore possible causes of
the decline of the East Asian summer monsoon must be discussed when the 4.2 ka BP
event occurring in the monsoon region was identified as a decrease in the monsoon-
related rainfall and thus a decrease in the summer monsoon intensity. As discussed in
the manuscript, in this regard, it is a logical and widely accepted way to compare the
record of the summer monsoon with climatic processes occurring in the low-latitude
western Pacific and in Northern Hemisphere high latitudes. It is worth mentioning
that the East Asian summer monsoon is completely different from the Indian summer
monsoon or the African summer monsoon because it can penetrate northward to the
areas beyond 45 degrees north. Just for this reason, the East Asian summer monsoon
is more largely influenced by climatic processes occurring in Northern Hemisphere
high latitudes. Regarding the Bond cycle and the Stott et al. SST reconstruction, we
don’t deny uncertainties in the interpretation of both records. But we think that both
records could be accepted before more precise proxy records are generated for the
two key regions.

Comments The reconstructed precipitation during the “4.2 ka event” (based on pollen)
is only 10% less than modern values (~260 v 285mm) so saying this represents “a
large decline of the EASM” (line 367) seems unjustified. I think the most significant as-
pect is the persistence of the reduced rainfall period, rather than the absolute amount.

Response We agree that the word “large” here might not be properly used, although “a
large decline of the EASM” is represented not by the reconstructed precipitation alone
but by the PCA F1 in which the 4 proxies were synthesized. We have deleted “large” from “a/the large decline of the EASM” in the manuscript. See lines 41, 325, 340 and
360.

Comments Did temperature play a role in driving P–E to extreme values? You don’t
discuss that, or the overall water balance very much.

Response As you know, it is extremely difficult to distinguish the role of temperature
from precipitation in driving the water balance of lakes using the proxies of the lake
sediments. Given that the 4.2 ka BP event is characterized by a cold event in many re-
gions of the Northern Hemisphere, however, the evaporation in the study region should
not be increased around 4.2 ka BP. In other words, the drought occurring in the study
region around 4.2 ka BP could be closely related to a decrease in the regional precipi-
tation at that time.

Comments Could there have been an increase in eolian sediment input that contributed
to a rise in the sand fraction?
Response No. Eolian deposits like the Chinese Loess are dominated, in grain size, by the silt fraction. So an increase in the eolian input cannot result in a rise in the sand fraction.

Comments Overall, this is a useful contribution to a Special Issue on the 4.2 ka B.P. event, as it demonstrates that there was a detectable climatic anomaly even at the northern limit of the East Asian summer monsoon.

Response Thank you for the favorable comment on our manuscript! We believe that we provided a valuable record of the 4.2 ka BP event for a key region on the globe.

Please also note the supplement to this comment: https://www.clim-past-discuss.net/cp-2018-66/cp-2018-66-AC1-supplement.pdf