

Interactive comment on “Holocene climatic evolution at the Chinese Loess Plateau: testing sensitivity to the global warming-cooling events” by Taslima Anwar et al.

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Authors' Response to Comments from Reviewer 1

Dear Dr. Nie,

Thank you very much for your constructive feedback, which provided valuable insights for our paper. As per your suggestions, we have addressed all the issues arisen and we do believe it responds to all the queries.

Best regards,

On behalf of the co-authors,

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Vadim A. Kravchinsky (corresponding author, vadim@ualberta.ca)

General Comments:

Based on a multi-parameter study of two sites (6 sections) in the East Asian monsoonal region, this paper found 3 warm-humid intervals during the Holocene in northern China. The age model of the studied section is based on OSL dating performed by previous work. I feel that this is a good contribution to the journal.

I have a few comments to help to further improve the paper, mainly its clarity. I consider the data quality high. Separating temperature from precipitation is a challenging task for paleoclimate research. In this case, I am convinced that there were 3 wet intervals during the Holocene in northern China based on their magnetic parameter records, but I am not sure if all the recognized wet periods are necessarily warm.

One way to test whether the three periods were both warm and wet is by comparing Xarm/SIRM and Xarm/Xlf variations, as is used before. If climate was both warm and wet, Xarm/SIRM and Xarm/Xlf should covary (Nie et al. 2013 QR; 2014SR). So I encourage the authors to pay more special attention to the subtle but recognizable changes between Xarm/SIRM and Xarm/Xlf. Particularly, I feel that the pedogenic feature is more apparent in the Xarm/SIRM record and the magnetic concentration parameter records, but is a bit damped in the Xarm/Xlf record on pages 45 (YZ1 section), 46 (YZ2 section), 47 (YZ3 section). For JJ3 section, the relationship between Xarm/SIRM and Xarm/Xlf seems more complicated. This suggests to me temperature and precipitation might not be as coupled as traditionally thought, at the examined timescale.

Response:

Thanks a lot to the reviewer for such a positive insight. We are obliged for the encouraging and inspiring words.

We have taken another look through our and Xarm/Xlf and Xarm/SIRM data (Figures

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9-13) to confirm the observed three warm-wet intervals based on the analysis by Nie et al., (2013; 2015). According to Nie et al. (2013; 2015), for the last 6 Ma the co-varying trend pattern for Xarm/Xlf and Xarm/SIRM records indicates that climate was both warm and wet like the present day climate conditions (higher precipitation corresponds to higher temperature); whereas the opposite trend pattern between Xarm/Xlf and Xarm/SIRM records suggest temperature and precipitation might not be coupled, unlike the present days. However, the analysis from Nie et al. (2013; 2015) is more appropriate for longer time scales (Ma). Our study time scale is two orders shorter and therefore the million year scale model cannot be directly applied to Holocene. For all our sections, Xarm/Xlf and Xarm/SIRM records show almost similar trends (Figure 9-13). We agree that there are slight changes between Xarm/Xlf and Xarm/SIRM records; however, two records do not show opposite trends. Besides, for longer time scales as discussed in Nie et al. (2013; 2015), these three Holocene soil layers (warm-humid periods) would correspond to just one paleosol layer. Therefore, based on the slight differences (not opposite trends) between Xarm/Xlf and Xarm/SIRM records only in this study, we are not convinced to conclude that temperature and precipitation might be decoupled for the Holocene. Moreover, it is widely accepted that higher magnetic parameter and finer magnetic grains (Figure 4-8) correspond to higher precipitation and temperature for the Quaternary (Zhou et al., 1990; Heller et al., 1993; Maher et al., 1994; Bloemendal and Liu 2005; Maher, 2011; Nie et al., 2013).

Minor Comment 1:

Magnetic susceptibility is defined as MS in line 166 and thus, magnetic susceptibility should not appear in the following text such as line 233 and 236.

Response:

Necessary changes have been made accordingly in the revised paper. We have kept magnetic susceptibility instead of MS in all the relevant lines in order to avoid any confusion with the Ms parameter.

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Minor Comment 2:

I don't agree with the observation that Xarm/SIRM and Xarm/Xlf covary with each other and with bulk grain size. There are subtle but recognizable differences in terms of Xarm/SIRM and Xarm/Xlf variations for several sections. I think the subtle differences might be because Xarm/Xlf is more affected by temperature variations, as is demonstrated by Nie et al. (2013) QR and (2014) SR. So by neglecting these changes might the authors not completely pull out all the encoded information from these records.

Response:

As discussed above, considering the Holocene timescale (~10 ka), Xarm/Xlf and Xarm/SIRM records indicate almost similar trends in this study (Figures 9-13). We agree that there are minor differences between Xarm/Xlf and Xarm/SIRM records; however, two records do not show clear opposite trends as it was observed in Nie et al. (2013; 2015) for 4.5-2.6 Ma. Therefore, based on our data, we have concluded that temperature and precipitation were coupled during the Holocene.

Minor Comment 3:

Some of the references are out-of-date and this paper didn't incorporate the new progresses about loess provenance. For example, loess's zircon U-Pb geochronology data exhibit most similarity with those of the Yellow River sediments (Nie et al. 2015, NC), not the Gobi desert, suggesting that the Yellow River drybed sediments are major source for loess. Accordingly to Licht et al. (2016) GSAB, Yellow River sediments take a proportion of 60-70% for loess provenance. However, in line Line 288, these new progresses did not get reviewed and incorporated.

Response:

We agree with the reviewer. We have made the necessary changes and have included Nie et al. (2015) and Licht et al. (2016) as references in the revised manuscript (lines 290-292).

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Minor Comment 4:

Can the author address the difference in terms of Holocene moisture evolution pattern between the East Asian region and the central Asian region? It seems that the Holocene Central Asian area moisture evolution is different from the East Asian monsoon region (Chen et al., 2008, QSR). If so, the authors might need to change the statement that the Holocene moisture pattern they observed is global.

Response:

We appreciate this query. In our study we observe the influence of temperature, precipitation, and wind strength on regional climate changes along the south-to-north eastern Chinese Loess Plateau. We reconstruct the East Asian monsoonal regional climate and environmental changes in the Holocene, and our results correlate well with other regional and global climate records (Figures 14 and 15) implying that climatic pattern of changes occurred in the eastern monsoonal Asian region during the Holocene appears to be registered globally.

Chen et al. (2008) proposed that the moisture history in arid central Asia is out-of-phase with that of monsoonal Asia during the Holocene. However, they suggested that further studies are necessary to test this hypothesis since they reviewed limited number of sites. Therefore, based on the study of Chen et al. (2008), we are not in the position to acknowledge this out-of-phase relationship in Holocene moisture evolution pattern between arid central Asia region and the monsoonal Asian region.

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