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Climate of the Past
Discussions

Interactive comment on "Centennial-scale monsoon changes since the last deglaciation linked to solar activities and North Atlantic cooling" *by* Xingxing Liu et al.

Anonymous Referee #2

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Comment on Liu et al. CP_2019_119 Title: Centennial-scale monsoon changes since the last deglaciation linked to solar activities and North Atlantic cooling Authors: Xingxing Liu, Youbin Sun, Jef Vandenberghe, Peng Cheng, Xu Zhang, Evan J Gowan, Gerrit Lohmann, Zhisheng An

In this study, a 13.5 m-long terrace succession (DDW) was retrieved from Dadiwan, on the western margin of Chinese Loess Plateau (CLP), to investigate the variation of rapid monsoon changes since the last deglaciation. The entire sequence was dated with 12 radiocarbon ages. In this study, the authors proposed that Zr/Rb and Rb/Sr ratios can be used as proxies for East Asian winter monsoon (EAWM) and East Asian

summer monsoon (EASM), respectively. In addition, the authors found an anti-phase relationship between the EAWM and EASM on centennial timescale during 16-1 ka BP. Comparing with North Atlantic cooling and solar activity proxies, the authors found that both factors dominated the East Asian monsoon (EAM) system during the early Holocene. But during the late Holocene, solar activity was no longer the main controlling factor of EAM. In general, the new data in this study could deepen our understanding of paleo EAM variations since the last deglaciation and the manuscript is worth publishing in this journal. However, this manuscript still has following shortcomings:

General comments:

1. Line 154-158: The authors said that grain size and magnetic susceptibility have been widely used as proxies for EAWM and EASM, respectively. Based on the fact that Zr/Rb and Rb/Sr ratios are highly consistent with grain size and magnetic susceptibility in the same sequence, the authors deduced that Zr/Rb and Rb/Sr ratios also can represent EAWM and EASM. If so, why don't you use grain size and magnetic susceptibility in this study? What are the advantages of Zr/Rb and Rb/Sr ratios?

2. In this study, the authors suggested that coarser particles in the sequence can be used as an indicator of stronger EAWM. However, it should be noteworthy that the dryland expanded southward during weak EASM periods. In this condition, coarse particles also could be transported to the study site even under a weak EAWM condition. Previous study suggested the advance–retreat cycles of desert is a dominant factor of grain-size, rather than winter monsoon (Ding et al., 1999). How do you corroborate that your EAWM proxy is reliable?

Ding, Z.L., Sun, J.M., Rutter, N.W., et al., 1999. Changes in sand content of loess deposits along a North–South transect of the Chinese Loess Plateau and the implications for desert variations. Quaternary Research, 52, 56-62.

3. Line 180-192: I'm not convinced that EASM changes recorded by DDW are consistent with the Lake Qinghai summer monsoon index (SMI) and the δ18O record from

Dongge Cave stalagmites. First of all, records from Lake Qinghai and Dongge Cave show a large fluctuation form YD to early Holocene, but the variation of Rb/Sr ratio is smooth. Secondly, Rb/Sr ratio of SSW indicate that EASM during the middle and late Holocene is stronger than early Holocene, which is opposite with the records from Lake Qinghai and Dongge Cave. Thirdly, the highest Rb/Sr ratio occurred during the middle Holocene, indicating a mid-Holocene EASM maximum. But both Lake Qinghai and Dongge Cave records show an early-Holocene EASM maximum. In fact, the result of mid-Holocene EASM maximum is consistent with a well-dated, pollen-based precipitation reconstruction from Lake Gonghai (Chen et al., 2015). The pollen record from Lake Gonghai has a resolution of $\sim$20 yr, which is sufficient to reveal centennial-scale summer monsoon changes. I recommend the authors to add this record for comparison in Fig. 3. By the way, although δ18O records from stalagmites have attracted extensive attention in paleoclimate studies due to their precise age controls, the interpretation of speleothem δ18O in China remains controversial (e.g., Liu et al., 2015). Especially in recent years, more and more evidences indicated that that cave speleothem δ18O records in China cannot be used as a reliable proxy of EASM rainfall. The authors should notice this issue when using stalagmite δ18O record.

Chen, F.H., Xu, Q.H., Chen, J.H., et al., 2015. East Asian summer monsoon precipitation variability since the last deglaciation. Scientific Reports, 5, 11186.

Liu, J.B., Chen, J.H., Zhang, X.J., et al., 2015. Holocene East Asian summer monsoon records in northern China and their inconsistency with Chinese stalagmite δ18O records. Earth Science Reviews, 148, 194-208.

4. The spectral results reveal that HSG, Zr/Rb and Rb/Sr records both display a prominent periodicity at 1.27 kyr during the late Holocene. Then the authors suggested that North Atlantic cooling were the major forcing of EAM system. However, in Figure 4, âŰş14C, Zr/Rb and Rb/Sr also have a prominent periodicity at $\sim$0.7 kyr, which indicated that solar activity could also contribute to EAM during the late Holocene. But it seems that periodicity of $\sim$0.7 kyr is missed during explanation.

Specific comments:

1. Line 81-82: Source of climatic information of Qin'an Country is unclear. The authors should cite related references.

2. Line 125: It would be better if the authors give the interpretation of “x” and “y” in the regression equation (y=1.1465x+1.2546).

3. I noticed that the 12 radiocarbon ages have a good linear correlation with depth (R2=0.9921). It means that accumulation rate was consistent whether during strong EAWM or weak EAWM. Usually, strong EAWM would result in a higher accumulation. Why is accumulation rate consistent? Did the episodic erosion affect it (e.g., Stevens et al., 2018)?

Stevens, T., Buylaert, J.P., Thiel, C., et al., 2018. Ice-volume-forced erosion of the Chinese Loess Plateau global Quaternary stratotype site. Nature Communications, 9, 983.

4. Line 133: A space character before “μm” should be added.

5. Line 134: The space character between “μ” and “m” should be deleted.

6. Line 194, 222 and 253: “Zr/Br” should be “Zr/Rb”.

7. The authors should add “δ” before “18O” in whole manuscript.

8. The reference style should be consistent. For example, in Line 292, “2.1-2.49” is incorrect. In Line 297, “24:” should be “24,”.

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