This manuscript demonstrates a series of high-resolved multi-proxy records between 9.0 and 7.9 ka BP based on a stalagmite named BH-2 with precise chronology from North China. The authors try to show a complete picture of the pre-, at and post-event of the 8.2 ka at centennial time scales, which did not receive enough concern before. However, the manuscript needs to be further improved since the advantages of the multi-proxy records have not been fully utilized.

Though the authors demonstrate the records of $d^{13}C$ and PC1 of trace element ratios besides $d^{18}O$ during the same time, the $d^{18}O$ is still the only proxy to be used to interpret the climate oscillations around the 8.2 ka BP. As $d^{18}O$ is a climate signal mixed with local and circulation information (i.e., EASM), whereas other proxies, like $d^{13}C$ and PC1 of trace element ratios mainly reflect the local climate change, the authors actually could try to find a way to separate the local and remote information in BH-2 $d^{18}O$ base on other proxies to improve the interpretation of $d^{18}O$.

Re: We thank the reviewer's concern about the issue of proxies' interpretation. We have to admit that it is difficult to find a way to separate the local and remote information in BH-2 $\delta^{18}O$ based on other two proxies, and this issue is a little beyond the scope of this study. Actually, the interpretation of speleothem $\delta^{18}O$ has long been discussed for decades of years and it is not easy to detangle the detailed inner processes because this proxy can be affected by many factors. It is now a consensus that speleothem $\delta^{18}O$ in ESAM region could indicate large scale consistent atmospheric circulations, which is supported by our previous reanalysis based on simulation results (Duan et al., 2023). In addition, one thing should be emphasized here is that although speleothem $\delta^{18}O$ in this study is interpreted to reflect local rainfall amount, it doesn't mean that these two parameters are linearly related, especially in longer timescales. We improve our discussions about the interpretation of these proxies in the last paragraph of section 4.1.

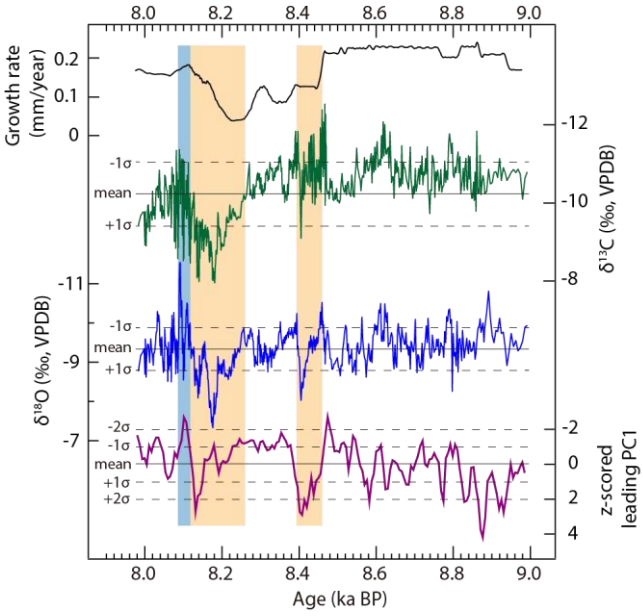
Another issue is, in Fig. 2, the first positive shift between 8.45 and 8.39 ka BP in PC1 is more prominent than the one around 8.2 ka BP, whereas the latter excursion around the 8.2 ka BP is the most remarkable in $d^{18}O$. On the opposite, in $d^{13}C$, the average value between 8.45-8.39 ka BP is around -11‰, which is lower than before and after. If all of them are related to hydroclimatic changes, why the behaviors of the first drought are so different from these 3 proxies? Or is there any new information could be discovered from their differences.

Re: Firstly, as we demonstrate in the last review comment, the relationship between $\delta^{18}O$ and trace element is necessary to be linear. Therefore, the more prominent first excursion in PC1 could reflect the impact of local precipitation that decoupled with the large scale atmospheric circulations. Secondly, the negative $\delta^{13}C$ can be explained by the source of $\delta^{13}C$ signal. As the interpretation of $\delta^{13}C$ in section 4.1, the density of vegetation cover, the biomass activity and the vadose seepage solution play a crucial role in the variations of BH-2 $\delta^{13}C$. Since the nonlinear response of vegetation to the climate change, $\delta^{13}C$ could be not always strictly follows the behavior of $\delta^{18}O$ and/or trace element. In other words, the vegetation system is quite resilient to the climate change. When the climate fluctuates in a limited range or short timescale, and thus doesn't reaches a threshold value, the vegetation (i.e., $\delta^{13}C$) won't exhibit dramatic excursions. In this study, pluvial

condition at ~8.46 ka BP can be inferred from both anomalously negative $\delta^{18}O$ and trace element, which could be responsible for the coeval negative $\delta^{13}C$ values. However, the $\delta^{13}C$ didn't follow the positive trend of the other two proxies during 8.46-8.39 ka BP, which could be attributed to the nonlinear relationship between the change of vegetation and hydrological conditions, in particular during short climate excursions.

And why not use ±1 SD of the PC1 to define the drought and wet condition as well? If using the same standard adopted by the isotopes, the rebound after the 8.2 ka must not be prominent in PC1 anymore. Not mention the PC1 variations before the 8.45 ka BP are different from the isotopes, and the most prominent positive excursions of PC1 is around 8.87 ka. Sine there is no rapid rebound in $d^{13}C$ record either, if all the proxies are related to local rainfall as the authors presumed, then the rebound after the 8.2 ka in $d^{18}O$ is not necessary to indicate a pluvial condition.

Re: As demonstrated above, one cannot expect these three proxies strictly follow each other due to various controlling factors. Below figure shows that the similar excursions at 8.46, 8.2 ka BP, and post-8.2 ka between PC1 and $\delta^{18}O$ can be observed even we define the drought or wet conditions by ±2 SD of the PC1. Therefore, our view about the rebound after 8.2 ka event is reliable. As for the $\delta^{13}C$ record, we think the vegetation is hard to rapidly flourish from the severe damage during the 8.2 ka event, leading to relatively positive values compared to that before. Moreover, in this study, we focus on the episode after 8.5 ka BP because of the similar behavior in them, thus the most prominent excursions at around 8.87 ka BP was not discussed. According to Figure S2, this anomalous event is most attributed to the Mg/Ca ratios and not conspicuous in Ba/Ca and Sr/Ca records. But the excursions after 8.5 ka BP is common in all records. Therefore, more evidence are needed to prove the reliability. Conclusively, the discrepancy among three proxies cannot deny the pre-, at-, and post-8.2 ka events we proposed.



In addition, as the authors mentioned that the two-drought pattern around the 8.2 ka BP also existed in other paleo-climate records, the readers would care is there any new

information revealed from the new high-resolved multi-proxy records or is there any direct evidence which could provide new clues for the mechanism exploration?

Re: We are not sure about the meaning of 'new information'. In our opinion, the main contribution of this study is trying to prove the global significance, instead of local phenomenon, of the sequence of climate events from 8.5 to 8.0 ka BP, which was not paid enough attention before. Many records, that only discussed the 8.2 ka event before, together with our new profiles, are compiled to demonstrate the existence of the other two excursions. About the mechanism, recent studies on the marine core from the North Atlantic are synthesized to show that these climate signals presumably come from the meltwater influx into the North Atlantic and associated AMOC strength. Still, more evidences with high resolution and accurate chronology are necessary to confirm the connection between the North Atlantic and the EASM domain.

Other minor comments:

Line 84, '1998 and 2010' should be follow by 'AD' or 'CE', please correct other relevant descriptions in the rest of the manuscript.

Done

Line 84-85, better to give the summer rainfall amount as well, to show most of the local rainfall are from the summer.

Done

Line 86-89: 'termed' should be 'related'.

Done

Fig. 2a, need to put a scale on the stalagmite profile

Re: The scale of sample is the same as that in subpanel b. We add this description in the revised version and put a scale in subpanel a.

Line 92, suggest to add '$d^{18}O$' before 'the results'.

Done

Line 101-103: the scan work belongs to the previous study (Duan et al., 2023), not to this study.

Re: The description is shortened and modified.

Line 109: 'international standards' need to be detailed with sample and No.

Done

Line 148: 'Mg/Ca' should be 'Ba/Ca'

Done

Line 151-152: Fig. 2 shows that before 8.46 ka BP, the PC1 derived from the trace elements demonstrate a general decreasing trend, which is different from the oxygen and carbon isotope variations.

Re: We add related description in this section.

Line 153, 'Aftermath' should be replaced by 'afterwards'.

Done

Line 184-197: I agree that the PC1 derived from Mg/Ca, Sr/Ca and Ba/Ca is mainly influenced by PCP. But it should be noticed that PCP occurs under dry conditions, so trace element ratios are more sensitively to drought, but not so sensitively to wet condition.

Re: We thank the reviewer for this suggestion and agree with it. This is the reason that trace element ratios can be used to indicate local wetness conditions. Under dry conditions, PCP occurs in the path way of solution and causes higher trace element ratios (i.e., PC1 values). In contrast, when hydroclimate is wet, sufficient precipitation supply can suppress the PCP processes, and thus more Ca element is preserved in solution to form lower trace element ratios.

Line 206-208: 'One noticeable feature of our δ18O record is a switch from relatively muted to highly variable episodes divided at ~8.5 ka BP, consistent with the absence and dominance of centennial to inter-decadal periodicity before and after 8.5 ka BP, respectively (Figure 2).' Why not carry on a periodicity analysis? And what cause the periodicity change before and after 8.5 ka BP?

Re: We thank the reviewer for this suggestion. The wavelet periodicity analysis result is added to Figure 2. As can be seen, the centennial to interdecadal periodicity is prominent after ~8.5 ka BP but almost absent before this time, consistent to what we demonstrated. About the mechanism to cause this phenomenon, we propose that in the background of overall strengthened ASM during 9.0-8.0 ka BP, a series of abnormal climate events originating from the high north latitudes lead to relatively more frequent high-amplitude oscillations in $\delta^{18}O$ profiles and hence more prominent periodicity after 8.5 ka BP.

Line 226, 'concert' should be 'concern'.

Re: We didn't change this because we think the phrase 'in concert with' means 'in agreement with', therefore is more suitable than 'in concern with' which tends to give a meaning of 'considering'.

Line 282, 'because high northern latitude climate variations can strongly affect the westerly changes and finally influence the EASM', 'affect' and 'influence' should be 'be affected' and 'be influenced'.

Re: We can't agree with this opinion. The anomalous climate signals in this study could originate from high latitudes and was transmitted to EASM through teleconnection, instead of the opposite processes.

Line 307-308, 'Intriguingly, speleothem record from Padre Cave (Cheng et al., 2009) fails to preserve as clear pre- and post- 8.2 ka events as its adjacent Lapa Grand Cave (Figure 4), presumably due to different cave settings.' This could not convince people.

We modify this sentence.

Line 319， need to give the whole name of the abbreviation of LAO

Done

Line 632-646: suggest to merge Fig. 3 and Fig. 4

Done

FigS1, the background is too dark, and it is difficult to figure out the locations. The $d^{18}O$ comparison figure is bit a mess. What is the purpose of the comparison?

Re: We modify this figure. Actually, we didn't mean to compare these data to give some conclusions, but collected the data we mentioned in our main text as many as possible.