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Climate of the Past Discussions

Interactive comment on "Timing and Structure of the 4.2 ka BP Event in the Indian Summer Monsoon Domain from an Annually-Resolved Speleothem Record from Northeast India" *by* Gayatri Kathayat et al.

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We express our gratitude to anonymous Referee 2 for the review of our manuscript. We find the comments supportive for substantially improving the manuscript. In the revised version we will incorporate the reviewer's comments. We respond to all the comments as follows.

Comment 1. The author claim (L.92) that a sharp increase in the speleothem δ18O values implies a weaker ISM at 4.07 ka. I agree, but some explanation is needed why

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Discussion paper

it is true

Answer 1. Our rationale for interpreting the temporal variations in δ18O values of speleothem from Northeast India in terms of changes in the Indian monsoon strength is provided in section 3.2. We will further improve its discussion in the revised version.

Comment 2. L. 198-200: "The ML.1 and ML.2 age models and associated uncertainties were constructed using COPRA (Constructing Proxy Records from Age model) (Breitenbach et al., 2012), Bchron (Haslett et al., 2008) and ISCAM (Fohlmeister, 2012) age modeling schemes (Fig. 3), respectively. Not quite. Copra, Bchron, and ISCAM were used only for ML.1 (Fig. 3). For ML.2, only COPRA was used.

Answer 2. The reviewer is right. We will correct this mistake in the revised version.

Comment 3. L. 218-220: the authors write "The subsamples (80μg) were continuously micromilled from ML. 1 and ML. 2 with typical increments between 50 and 100μm (dependent on growth-rates) along the stalagmites growth axes. This is a mistake. The growth-rate dictates the age difference between the drilled samples. It does not affect the distance between the samples, which are drilled, regardless the growth-rate, with typical increments between 50 and 100μm.

Answer 3. As a matter of fact, we did use growth rate variations as a basis for determining the sub-sampling resolution for isotopic measurements. We will add new text in the method section to describe our sampling protocol.

Comment 4. In L. 220 the authors write that δ13C was also measured. It is OK with me that the paper is based only on δ18O values, however, I suggest adding a short explanation why δ13C values are not shown and are not discussed in the present manuscript.

Answer 4. In the revised version, we will add two new Supplementary Figures in the supplementary section that show the ML.1 and ML.2 δ13C profiles.

Comment 5. In L. 239, the authors write that: "The ML.1 and ML.2 δ18O values range

between -6.6‰ and - 4.4‰ with mean values of -5.80‰ and -5.43‰ respectively. Please check the values. I don't see any δ18O higher than -5‰ in Fig. 4. O values of 0.4‰ between the two 18 L. 240-242: "A slight but systematic offset in the mean records may possibly stem from karst-related difference in the drip and/or degassing rates." Please check the number. Examining the profiles shown in Fig. 4, I do not see an offset in the order of 0.4‰ between the two profiles. It seems to me that the offset is much lower. If so, then the explanation given in lines 241-2 is not necessary.

Answer 5. We thank the reviewer for pointing this out. We will correct this error in the revised version. We have added a new figure in the supplementary section that addresses the referee's comments.

Comment 6. The difference obtained between the isotopic profiles of ML.1 and ML.2 and KM-A (Berkelhammer et al., 2012), is rather puzzling. It seems to me that the reason for the very low δ18O values measured for the time interval 3.9-3.7 ka in KM-A, not recorded in ML.1 and ML.2, is most likely due to diagenetic alteration of the top of the stalagmite, and I recommend to carefully examine the petrography of that portion and find evidence for recrystallization. It could be also that the youngest age (3.654 ka) measured for KM-A is incorrect. Since Berkelhammer is also a co-author in the present paper, I believe that the authors have access to KM-A stalagmite.

Answer 6. Unfortunately, we are unable to do further analysis on the KM-A sample for three reasons: 1) There is negligible material left at the top portion in the KM-A stalagmite. 2) The KM-A sample now serves as the Meghalayan Stage Stratotype and therefore it is now preserved by the International Geological Congress. 3) Additional analysis on the KM-A sample is beyond the scope of our present study.

Comment 7. L. 265-270: "The 4.2 ka event in the KM-A record manifest as a two-step change, marked by O values (0.6‰ between 4.315 and 4.303 ka followed by a second 18 an initial increase in δ18O and more abrupt increase between 4.071 and 4.049 ka BP. . .... The authors claim that the timing of most significant increase in both ML.1 and

ML.2 δ18O values is similar to that observed in the KM-A profile though the amplitudes of δ18O change in our records are smaller by 0.5 ‰. However, whereas the 4.07 ka event is clear and significant also in ML.1 and ML.2 records, it is hardly observed at the 4.3 ka event.

Answer 7. The reviewer is right that the 4.3 ka event peak is not visible on the ML.1 and ML.2 profiles. We will clarify this discrepancy in the revised version.

Technical Remarks:

Technical Remarks 1. In the Abstract (L. 20-22) it is written: "Our δ18O record is constrained by 18 230Th dates with an average age uncertainty of $\pm$13 years and a dating resolution of 40 years. . . . . ." Whereas in L. 109 it is written that : "The ML.1 and ML.2 chronologies are established by 18 230Th dates with age uncertainty of $\pm$13 years (average dating resolution of 40 years) and 5 230Th dates with age uncertainty of $\pm$16 years. . . . . " i.e., 23 230Th ages.

Correction 1. We will revise the abstract to address the reviewer's comments.

Technical Remarks 2. In L. 107 it is written: "δ18O records span from 4.440 to 3.780 ka BP and 4.530 to 3.370 ka BP, respectively. . . . . However, according to the data shown in Fig. 2, the measured 230Th ages for ML.2 range between 4.541 and 3.479 ka. Please check.

Correction 2. We will make the correct corrections in the revised version.

Technical Remarks 3. In L. 108, the authors claim that "Our new record is sub-annually to annually resolved" whereas in L. 100 it is written that the "average δ18O resolutions of 1 and 5-year, respectively.

Correction 3. We will clarify this in the revised version.

Technical Remarks 4. In L. 141, I suggest to write: "The temperature variations in the cave are small (varying between 18.0–18.5°C) and. . ..."

Correction 4. We will make the correct corrections in the revised version.

Technical Remarks 5. L. 165: “above the cave floor in November 2015, 700 meters from. . .”

Correction 5. We will make the correct corrections in the revised version.

Technical Remarks 6. L. 181: For sake of consistency (see L. 178), should be: “(Cheng et al., 2000 and 2013).”

Correction 6. We will make the correct corrections in the revised version.

Technical Remarks 7. In Fig. 4, only 3 ages are shown for ML.2. At least the 4.5 ka age should be added.

Correction 7. We will add a Table (Table 1) in the main text that shows all (both Ml.1 and ML.2) the 230Th dates.

Technical Remarks 8. L. 262: “ISM variability recorded between KM-A and ML δ18O profiles Should be: “recorded by KM-A. . ...

Correction 8. We will make the correct corrections in the revised version.

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