Anonymous Referee #1

Received and published: 16 May 2016

General comments: This study looks at how d18Oprecip relates to temperature and precipitation over the East Asian monsoon regions on time scales of variability from seasonal to millennial using an isotope-enabled atmosphere-only climate model. The authors find interesting results that they say mean that d18O speleothem records should be interpreted with caution. I am very supportive of such modelling work to help the palaeoclimate community to better understand how isotopic data might be interpreted. I did though find the paper was quite descriptive and short in its explanations, and would benefit from the addition of further investigation into all the main points they made in order to improve the mechanistic understanding (see comments below). I recommend this be done before the manuscript can be published.

We would like to appreciate the anonymous reviewer for her/his helpful and thoughtful comments. The original comment (Q) and our response (A) are as follows:

Q: Specific corrections: Abstract Line 1: change "Water isotope in precipitation has played a key role" to "Water isotopes in precipitation have played a key role"
A: Done.

Q: Abstract line 1: add references to support the first statement
A: Since it is not allowed to add reference in the abstract part for format reason, the references are included in the first statement of the main text.

Q: Abstract line 5: Although I realize 'thru' is sometimes used for ranges esp. in American English, I would recommend changing "22ka thru 00ka using an isotope-enable AGCM" to "22 ka to 0 ka using an isotope-enabled atmospheric global circulation model (AGCM)".
A: Thanks. It is changed. Also, all the expression of "isotope-enable" in text are changed to "isotope-enabled".

Q: Abstract line 7: "Our study confirms the robustness of the temperature and amount effects on the seasonal cycle over China" – does this statement refer just to the present day? Please add to the text.
A: We have checked the two effects (temperature effect and amount effect) on seasonal cycle timescale in present day and the past slices in the model outputs. The Extended Fig 1 shows an example for North China. We can see the conclusion based on the present day conditions does not change much during the last 22,000 years. But given lack of the observations at seasonal timescale for the past, we would prefer to make the conclusion, in this paper, just for the present day, as compared to the observed monthly data from GNIP. Thanks, we added "in the present climatic conditions" in the text to explicitly clarify this point.

Q: Abstract line 8: "our analysis does not show significant temperature and amount effects over China on millennial and interannual timescales" – do you mean no significant change, or neither is significantly dominant?

A: The second one. This sentence was changed to "our analysis shows that neither temperature nor amount effect is significantly dominant over China on millennial and interannual timescales".

Q: Introduction page 1 line 13: "Sturm et al., 2010; Noone, 2008" – add an 'e.g.' and perhaps reference to some of the older earlier pioneering papers on this

A: Thanks, it is changed. Also, we added four pioneering papers, such as Dansgaard1964, Grootes1993, Cuffey1995, and Salamatin1998.

Q: Introduction page 1 line 15: ""local temperature effect", whereas the d18O-precipitation relationship in the tropics and low latitudes tends to be associated with the "amount effect" – I would be keen to see a small amount of explanation of these terms for any readers who might be relatively new to the subject.

A: Thanks! We added "a positive correlation between d18O in precipitation and the temperature of ambient air (warmer air provide more energy to rain out 18O-rich water vapor)" to briefly describe the temperature effect, and added "a negative correlation between d18O in precipitation and the accumulated total rainfall at local and upstream regions (stronger tropical precipitation leave less d18O in vapors transported to the subtropics and low latitudes)" to briefly introduce the amount effect in the text.

Q: Page 2 line 9 Change "East Asia locates at the transition zone" to " East Asia is located at"

A: Done.

Q: Page 2 line 10 "still remains as a great controversy" – delete "as"

A: Deleted.

Q: Page 2 line 11 and all other instances of "isotope-enable GCM" change to "isotope enabled GCM"

A: Thanks! We changed all the instances of "isotope-enable" in the text to "isotope-enabled".

Q: Page 2 line 20: delete "proxies".

A: Deleted.

Q: Page 2 line 26: "These experiments are forced by the realistic green house gases (GHGs) concentrations, orbital parameters, land ice sheet and land-ocean mask" – are these all the same boundary conditions as used in the Liu et al. papers, as well as the SSTs/sea-ice?

A: Yes, all the boundary conditions are the same as used in Liu et al. (2009).

Q: Page 2 line 30: "1.6‰ (22ka) to 0.5‰ (0ka)" - please say/reference where you have derived the values from, which have then been linearly interpolated, if I understand right.

A: They came from other scientist's work. References added: Schrag et al. (1996) for 22ka and Hoffmann et al. (1998) for 0ka.

Q: Page 3 line 1: add reference for the GNIP data
A: Reference added: Schotterer and Oldfield (1996).

Q: Page 3 line 3: change "This dataset has sufficient spatial coverage. But majority of: : :" to "This dataset has sufficient spatial coverage but the majority of: : :"
A: Done.

Q: Page 3 line 4: change "there is only12 stations" to "there are only12 stations"
A: Done.

Q: Page 3 line 4: change 'showing' to 'shown'
A: Done.

Q: Page 3 line 18: "For each region, the modeled seasonal cycle are derived from" change to "For each region, the modeled seasonal cycle is derived from"
A: Done.

Q: Figure 2: I know the names of the GNIP stations used are included in the plot, but is it also possible to add in the number that corresponds to the number of the site in figure 1.
A: Sorry I did not understand your question clearly. Do you suggest us to add the station's number into station's name in the text? Or to add a table for 31 GNIP stations? In this revision, we tentatively give the table to you as supportive material. We can put it into the text in the next revision if necessary.

Q: Figure 2: The comparison of the left and right hand graphs is slightly improved as the y-axes have different limits. While I see that this is to maximize the details, it would be easier to make comparisons if the scales were the same. – Actually I realize this is mentioned on page 4 in the penultimate paragraph.
A: Many thanks! The left and right columns share the same y-scale in this revision. The arguments still remain.

Q: Page 3 line 20: why only use the 'GNIP station that has the longest records in that region' in the comparison in figure 2. Have you checked whether there is good correspondence between the one record chosen for each region and the other shorter records in the region? I.e. is each particular record indicative of the overall pattern in the region? Otherwise it seems insufficient reason to choose a particular record based on its length, or say why a longer record is better – e.g. to reduce the impact of interannual variability? Related to this – page 4 paragraph around line 25 – states that the d18O values have somewhat different magnitudes although the phase is a good match with the data, however, there are similar differences in precip and temperature between model and data (as I'd imagine with most models), which might be worth also pointing out in this paragraph.
A: Yes, we did so to reduce the uncertainty of interannual variability. Given the feature of GNIP data's discontinuity (A. many missing within a year; B. observed years is way so short, commonly no more than 10 years, say from 1985 to 1993), as shown in Fig 1(b), the longer

records one station has, the better quality in representing reliable seasonal cycle feature of d18O/temperature/precipitation. The Extended Figure 2 shows an example for NE China: QIQIHAR station, the one used in our study that has longest records among the 4 stations in this region, gives a highly consistent seasonal cycle as the mean. We checked this point for other regions and the same thing happened. The bad continuity and missing of GNIP records in China leads the current method, selecting the site having long and complete observation history, is more important than using as much records as possible.

Q: Page 4 line 8: discusses that the d18O signal from the model in southern China doesn't replicate the seasonal pattern in the data and suggests a resemblance to the 'third mode' as discussed in the following paragraph. However, no mention is made of the fact that the seasonality of precipitation isn't quite right over S China either and how this could influence the mismatch between the model and data d18O.
A: Thanks for this helpful comment. We rewrite the sentence like this: "Instead, the modeled d18O in southern China exhibits a double maximum in spring and fall partly due to the incorrect seasonality of precipitation with its maximum occurred near May-June. The model cannot well reproduce the climatology in this region as it slightly resembles the third mode to be discussed next." Hope it is easier for readers.

Q: Page 4 line 18: change 'implications to the interpretation' to 'implications for the interpretation'.
A: Done.

Q: Page 4 line 20: 'Thus, we would suggest that one should NOT interpret the d18O records around this region simply as the monsoon rainfall amount.' One could also suggest that the boundaries between these different regions could change significantly over time (through glacial-interglacial cycles fro example). It would be useful if the authors could say something regarding this uncertainty and the implications for interpretation of palaeo-isotopic records.
A: Thanks! The changes of Asian monsoon advancing/retreating during glacial-interglacial cycle are much smaller than the amplitude of seasonal cycle of d18O/T/P. Thus, the position of this transition region is robust across glacial-interglacial cycle and change little. Extended Figure 4 shows the model results from time slices other than 00ka (Fig 3a and b). We can see the model suggests a robust and almost stationary "blank region" over the central China.

Q: Page 4 line 31: 'This distinctively different three regions' change to 'These three distinctively different regions'
A: Done.

Q: Page 5, line 10-15 These lines contain a suggestion of why south Asia and East Asia show different correlations between d18O and temp/precip on interannual timescales, but not enough detail to understand the mechanisms for this beyond them having different moisture sources. I suggest a clearer and more detailed explanation is necessary here.
A: Thanks. This point is also closely related to the penultimate question about the relationship between Chinese d18O and Indian monsoon. Please find our response and associated reference

in following part. We added words to discuss the relationship in this revision.

Q: Page 5 line 20: 'using the last 40 years of model output' do you mean where each of the 23 year time slices provides one time point that is the average of the last 40 model years of that simulation. Text could be a bit clearer.
A: Thanks. This sentence is changed to "The millennial climatology is derived from each time slice by averaging the last 30 years out of 50-year raw results." We checked the code, it should be last 30 years rather than 40 years. We revised text and figure captions accordingly.

Q: Page 5 line 25 onwards: it is an interesting result that millennial-scale variability in d18O doesn't reflect high significance in correlation with local temperature or precip. In line with other studies, the authors suggest that d18O over East Asia could be influenced by upstream moisture transport from the Indian monsoon region (similar to Pausata et al). However, they do not investigate this any further in their model so we do not learn as much as we could about what mechanisms are important factors here. The authors have all the data at their disposal and so could look at e.g. correlation at the millennial time-scale of Indian monsoon temp/precip/d18O with d18O over China, and variability in the southerly monsoon winds etc. I would like to see the authors examine what is driving their millennial scale variation further.
A: Thanks! In another paper (Liu and Wen, et al., 2014) with focus on the summer monsoon dynamics, we investigated the variability of d18O on orbital timescale over China, and its relations to Indian precipitation as well as the southerly monsoon winds. Basically, Chinese d18O highly correlated with Indian d18O and precipitation, suggesting a reliable dynamic link between Indian precipitation and Chinese isotope records through amount effect. On the other hand, East Asian monsoon is also influenced by the western North Pacific and South China Sea rather than just the Indian Ocean. The complex circulation determines China's nature having multiple modes of precipitation and d18O. We added some discussion for this part in section 3.2, 3.3, and 4.

Reference: Liu, Z and X Wen et al., 2014: Chinese cave d18O records representing East Asia summer monsoon, Quan. Sci. Rev., 83, 115-128.

Q: Page 5: line 25: Related to the above point, does the seasonality of precipitation/ temperature/d18O change much in the different locations in these 23 time slices? Do the seasonal correlations, interpreted as d18O being affected by the temperature effect in the north and the precipitation effect in the south still hold for the same locations or do the boundaries change from glacial to interglacial time slices?
A: Similarly, please take a look at the Extended Figure 3 for the spatial distribution of temperature/amount effects on seasonal timescale across 20ka, 15ka, 10ka, 5ka, and 0ka. It is shown that the pattern, temperature dominating north and precipitation dominating south, does not change much in the last 20,000 years. You may also find the same clues in Extended Figure 1 for the details of d18O/T/P seasonal cycle over North China, as an example, across the last 22,000 years.

Extended Figures to Reviewer #1

ExtFig 1. The solid seasonal cycle of d18O/temperature/precipitation over North China across the past 22,000 years. The domain is shown in the bottom-right corner.

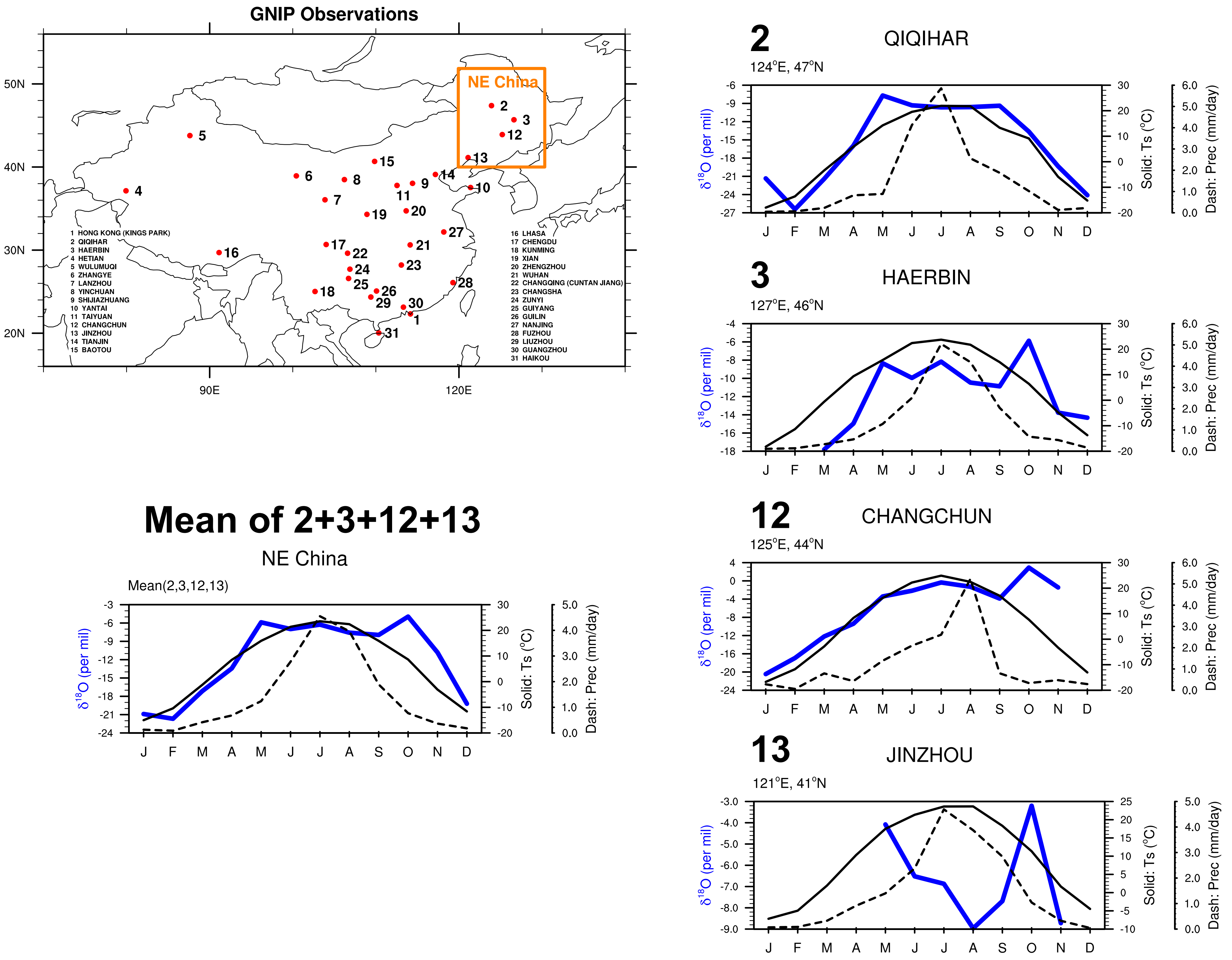
ExtFig 2. A demonstration of selecting GNIP site with longest records for Northeast China. The bad continuity and missing of GNIP records in China leads the current method, selecting the site having long and complete observation history, is more important than using as much records as possible.

ExtFig 3. The spatial patterns of temperature and amount effects at seasonal timescale across the past 22,000 years.

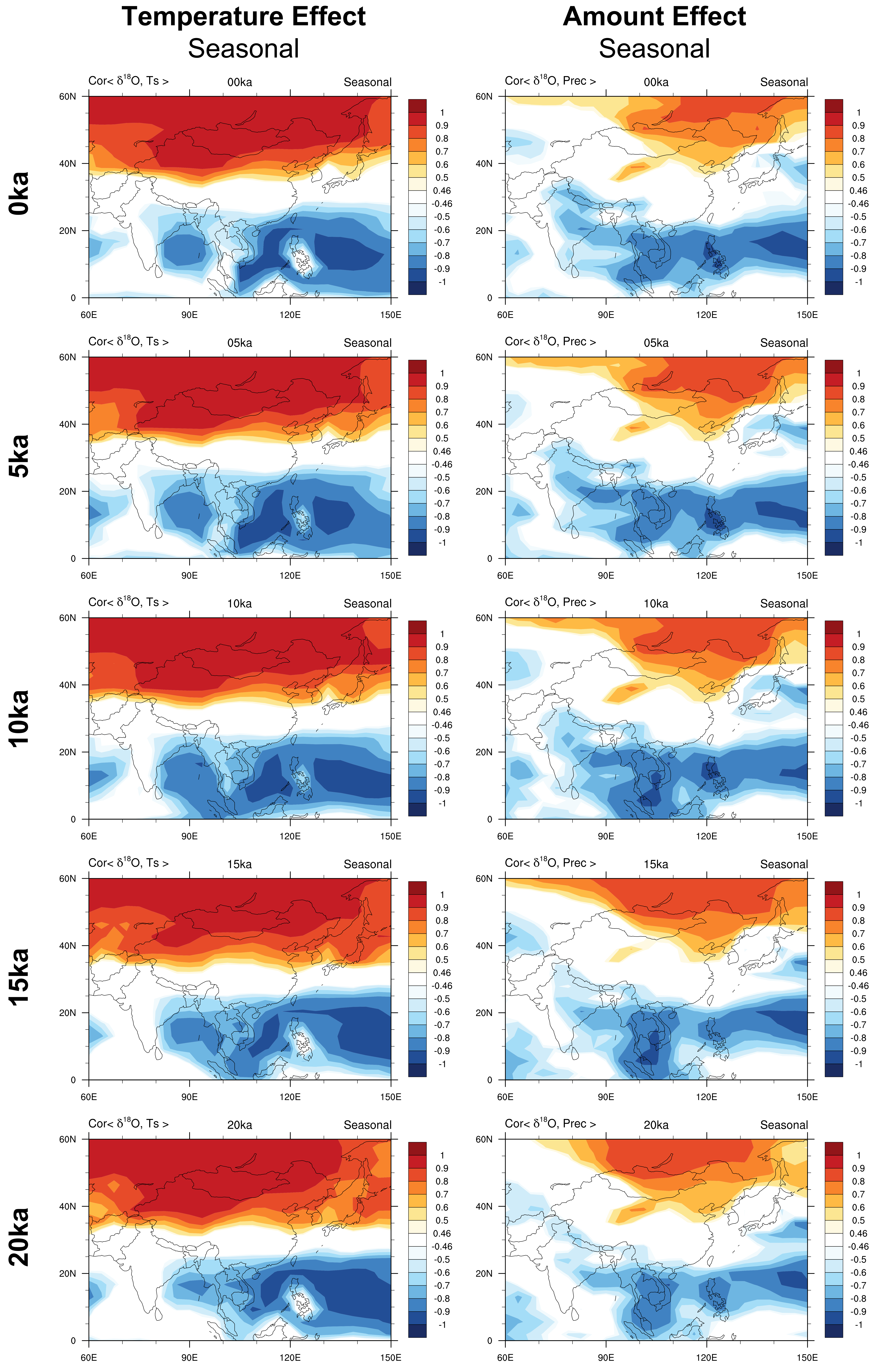
Table 1. **Basic information of 31 GNIP stations in China**

No.	Station Name	WMO ID	Longitude (°E)	Latitude (°N)	Altitude (m)
1	HONG KONG (KINGS PARK)	4500400	114.2	22.3	66
2	QIQIHAR	5074500	123.9	47.4	147
3	HAERBIN	5095300	126.6	45.7	172
4	HETIAN	5182800	79.9	37.1	1375
5	WULUMUQI	5182801	87.6	43.8	918
6	ZHANGYE	5265200	100.4	38.9	1483
7	LANZHOU	5288900	103.9	36.1	1517
8	YINCHUAN	5361400	106.2	38.5	1112
9	SHIJIAZHUANG	5369800	114.4	38.0	80
10	YANTAI	5369801	121.4	37.5	47
11	TAIYUAN	5377200	112.6	37.8	778
12	CHANGCHUN	5416101	125.2	43.9	237
13	JINZHOU	5433700	121.1	41.1	66
14	TIANJIN	5452700	117.2	39.1	3
15	BAOTOU	5452701	109.9	40.7	1067
16	LHASA	5559100	91.1	29.7	3649
17	CHENGDU	5629400	104.0	30.7	506
18	KUNMING	5677800	102.7	25.0	1892
19	XIAN	5703600	108.9	34.3	397
20	ZHENGZHOU	5708300	113.7	34.7	110
21	WUHAN	5749400	114.1	30.6	23
22	CHANGQING (CUNTAN JIANG)	5751600	106.6	29.6	192
23	CHANGSHA	5767900	113.1	28.2	37
24	ZUNYI	5771300	106.9	27.7	844
25	GUIYANG	5781600	106.7	26.6	1071
26	GUILIN	5795700	110.1	25.1	170
27	NANJING	5823800	118.2	32.2	26
28	FUZHOU	5884700	119.3	26.1	16
29	LIUZHOU	5904600	109.4	24.4	97
30	GUANGZHOU	5928700	113.3	23.1	7
31	HAIKOU	5975800	110.4	20.0	15

22ka
N China
$CC_{d18o-Ts}$= 1.0 $CC_{d18o-Prec}$= 0.8
21ka
N China
$CC_{d18o-Ts}$= 1.0 $CC_{d18o-Prec}$= 0.9
20ka
N China
$CC_{d18o-Ts}$= 1.0 $CC_{d18o-Prec}$= 0.9
19ka
N China
$CC_{d18o-Ts}$= 1.0 $CC_{d18o-Prec}$= 0.9
18ka
N China
$CC_{d18o-Ts}$= 1.0 $CC_{d18o-Prec}$= 0.8
17ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
16ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
15ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
14ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
13ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
12ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
11ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
10ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.7
09ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
08ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
07ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
06ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
05ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
04ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
03ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
02ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
01ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
00ka
N China
$CC_{d18o-Ts}$= 0.9 $CC_{d18o-Prec}$= 0.8
$\delta^{18}O$ (per mil)
Solid: Ts (°C)
Dash: Prec (mm/day)
J F M A M J J A S O N D
N China
40N
20N
90E
120E



GNIP Observations
NE China
50N
40N
30N
20N
90E
120E
1 HONG KONG (KINGS PARK)
2 QIQIHAR
3 HAERBIN
4 HETIAN
5 WULUMUQI
6 ZHANGYE
7 LANZHOU
8 YINCHUAN
9 SHIJIAZHUANG
10 YANTAI
11 TAIYUAN
12 CHANGCHUN
13 JINZHOU
14 TIANJIN
15 BAOTOU
16 LHASA
17 CHENGDU
18 KUNMING
19 XIAN
20 ZHENGZHOU
21 WUHAN
22 CHANGQING (CUNTAN JIANG)
23 CHANGSHA
24 ZUNYI
25 GUIYANG
26 GUILIN
27 NANJING
28 FUZHOU
29 LIUZHOU
30 GUANGZHOU
31 HAIKOU
Mean of 2+3+12+13
NE China
Mean(2,3,12,13)
2 QIQIHAR
124°E, 47°N
3 HAERBIN
127°E, 46°N
12 CHANGCHUN
125°E, 44°N
13 JINZHOU
121°E, 41°N
δ18O (per mil)
Solid: Ts (°C)
Dash: Prec (mm/day)
J F M A M J J A S O N D



Temperature Effect
Seasonal
Amount Effect
Seasonal
0ka
5ka
10ka
15ka
20ka
Cor< δ18O, Ts >
Cor< δ18O, Prec >
00ka
05ka
10ka
15ka
20ka
Seasonal
60N
40N
20N
0
60E
90E
120E
150E
1
0.9
0.8
0.7
0.6
0.5
0.46
-0.46
-0.5
-0.6
-0.7
-0.8
-0.9
-1

Anonymous Referee #2

Received and published: 16 May 2016

We would like to appreciate the anonymous reviewer for his/her helpful comments! The major revision include performing 4-member AMIP runs and changing the indicator of temperature effect. The original comment (Q) and our detailed response (A) are as follows:

Q: The authors used a list of time slice experiments by an isotope-enabled GCM to evaluate the changes in precipitation d18O on various timescales. It is an interesting work and might give some insights for the interpretation of stalagmite d18O, especially for the paleoclimate reconstructions in Asia. I do not know whether these experiments are the same as those in Liu et al. 2014 QSR or not. The authors should clarify this in the section of model description. These experiments are no doubt useful for exploring the interpretation of the precipitation d18O over the East Asian on different time scale. However, I am afraid that the present experiment design is not reasonable enough for examining the changes in d18O, especially on the seasonal and interannual timescales. The present 0Ka experiment may neglect some major changes in boundary conditions and can not directly compare to the modern GNIP observations. Are the greenhouse gases and sea surface temperature kept constant? Why do the authors not employ the observed GHG and SST to force the atmosphere model? This experiment is necessary and do not need much time. I strongly recommend to add this experiment and to reanalyze the results.

A: Yes, the numerical experiments are the same as those in Liu and Wen, et al. (QSR, 2014) but with different research goals. We added sentences in section 2 to clarify this point. In Liu's paper (2014), we discussed the dynamic linkage between Chinese d18O and East Asian summer monsoon, whereas in this paper we would like to discuss the robustness of interpreting d18O records in terms of two effects on three different timescales: seasonal, interannual, and millennial.

At the early stage of this work, we planned to focus on 4 timescales: millennial, interdecadal, interannual, and seasonal. But the big problem is lack of observed d18O record on interannual-to-interdecadal timescales. Most of the records from GNIP network have no more than 8 years (1985-1993), as shown in Fig 1b. Thus, we removed the "interdecadal" and focus on the remaining three, among which the "interannual timescale", relatively, could be the one lacking observations most. In general, the interannual variability of d18O or other variables include two sources: climate system internal variance and responses to external forcing. The observed d18O records are too short to reliably account for both. Our 00ka slice was driven by 1950 boundary conditions and was integrated for 50 years, which is able to provide enough interannual information than GNIP for internal variability problem, but for forcing-response problem. This is the shortage of current experiments. Appreciate the reviewer's kind suggestion! In this revision, we performed a 4-member ensemble AMIP-type runs covering the period 1975-2004 (30 years in total) with external forcing of observed SST/SICE and GHGs. As an example, Extended Figure 1 shows the interannual variabilities of JJA d18O in the new runs and GNIP at Hong-Kong, a site having longest records in China (as shown in

Fig. 1b). We found that: 1) the results at interannual scale change evidently. So we revised Figure 3 and 4 and related text accordingly. 2) almost no change can be found at seasonal scale, since the amplitude of seasonal cycle is much greater than the interannual variance (also can be found in Fig. 4).
Moreover, we keep both the interannual results from 00ka and new AMIP runs in Fig. 4 to help readers to understand their differences. Apparently they still fall into the same "interannual regime" with little differences. It could be noted that not easy to separate internal variance (00ka results) and forcing-response variance (newly conducted AMIP runs) at this timescale.

Q: The authors use a series of time-slice experiments for the last 22 ka to evaluate the "temperature effect" and "amount effect" on millennial time scale in different regions in East Asia. I think that the author should present the long-term changes of precipitation d18O in these model simulations and compare them with the proxy records. If the outputs of these experiments capture the variations in the proxy time series, then it's robust to test the interpretation of the precipitation d18O on millennial time scale by using the model simulation. Otherwise, the bias in the model itself will mask the real processes which affect the precipitation d18O changes. This is fundamental to the model simulation. The authors must cross check the model outputs with the real observations and then come to the conclusion.

A: We compared the model results (d18O, precipitation, and meridional winds) with proxy data in Liu and Wen, et al. (QSR, 2014). It is shown that the model successfully reproduces the observed orbital and millennial variability as compared to multiply proxies and generates reliable monsoon-associated anomalous circulation (in Liu et al., QSR, 2014, Fig 2e shows model results by comparing with d18O proxy and V winds; Fig 2f and 2g shows the comparison of modeled precipitation and other lake sediment proxies). This forms the solid base for present investigation.

Reference: Liu, Z and X Wen et al., 2014: Chinese cave d18O records representing East Asia summer monsoon, Quan. Sci. Rev., 83, 115-128.

Q: As shown in figure 3, the authors correlate the annual mean d18O weighted with precipitation to the DJF temperature and JJA precipitation on the interannual and millennial time scales (panel c-f) and then use this statistic result to argue the "amount effect" and "temperature effect". This is totally wrong! Because the annual mean temperature may not change the same way as the DJF temperature, and also the varied precipitation seasonality (as shown in figure 2) in different regions may deny the dominant contribution of summer precipitation to the annual precipitation.

A: Many thanks! The observed d18O records in speleothem, fundamentally, reflects precipitation-weighted annual mean. For Asian monsoon region, it could be considered that these cave d18O records mostly reflect summertime rather than wintertime information. Appreciate the reviewer's suggestion. Here, we re-examine this problem for millennial (Extended Figure 1) timescale, as an example. It is shown that the p-weighted annual mean of temperature and JJA mean precipitation could be the appropriate ones accounting for temperature effect and amount effect. They are even more reasonable than monthly equal-weighted annual mean by emphasizing rain-season footprint. We revised Figure 3 and text accordingly in this revision.

We further investigate the robustness of interannual patter (as above) of temperature/amount effects across the past 22,000 years (say, 20ka, 15ka, 10ka, 5ka, and 0ka), as shown in the Extended Figure 3. It is shown that the weak correlation region (the blank region) does not change much, suggesting the conclusion that one should be very cautious in interpreting d18O records for this area on interannual timescale still remains.

Q: Page 1 line 19, the citation of Yuan et al., 2004 is wrong. It presents the speleothem d18O record from southern China.

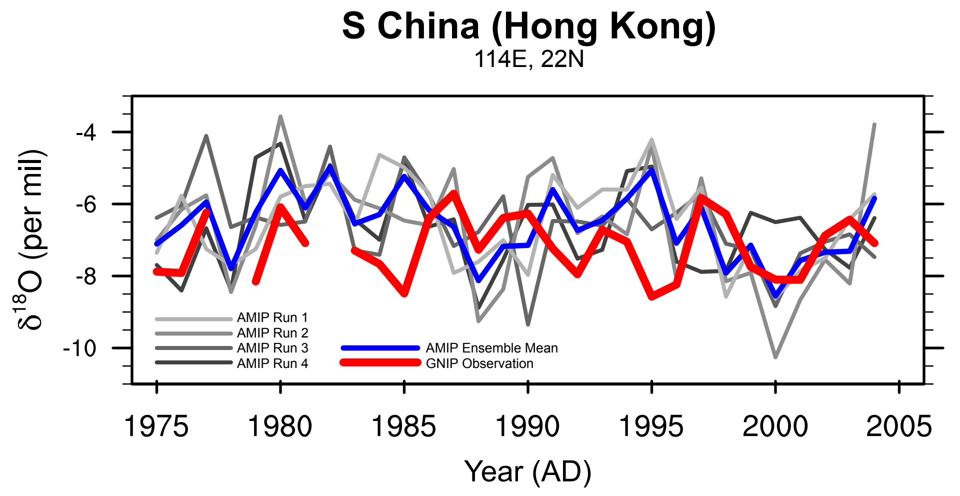
A: Thanks, we moved this item to speleothem part.

Extended Figures to Reviewer #1

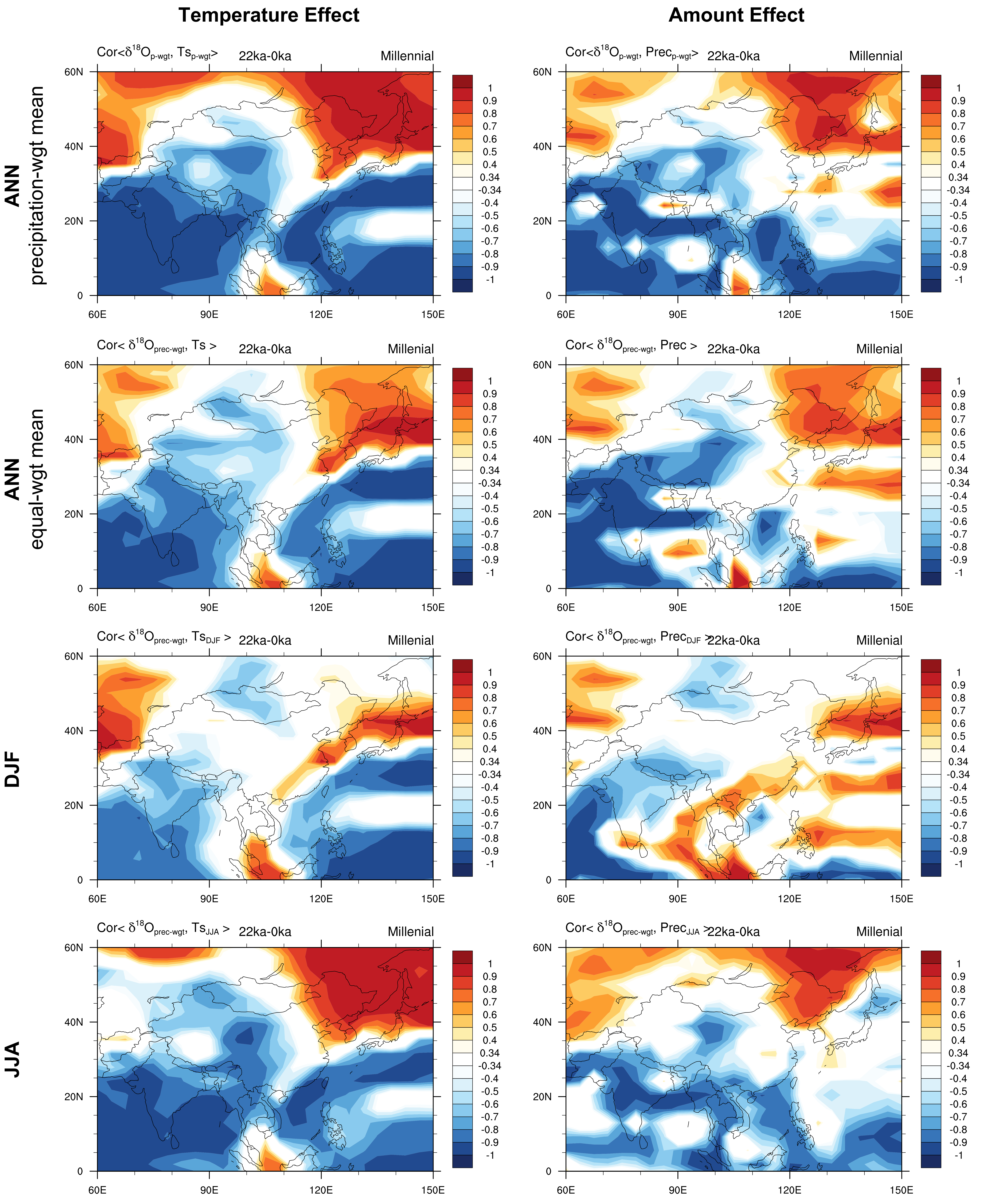
ExtFig1. Timeseries of JJA mean d18O in 4 AMIP runs and GNIP observation at Hong-Kong station.

ExtFig2. Check the indicators for temperature and precipitation effects. We select CC(d18O$_{p\text{-}wgt}$, TS$_{p\text{-}wgt}$) as the temperature effect indicator; CC(d18O_p-wgt, PREC$_{JJA}$) as the amount effect indicator.

ExtFig3. The solid spatial pattern of temperature and amount effects at interannual timescale across the past 22,000 years.


S China (Hong Kong)
114E, 22N
δ18O (per mil)
-4
-6
-8
-10
AMIP Run 1
AMIP Run 2
AMIP Run 3
AMIP Run 4
AMIP Ensemble Mean
GNIP Observation
1975
1980
1985
1990
1995
2000
2005
Year (AD)

Millennial Timescale



Interannual Timescale