***Replies to the comments on "Effects of changes in moisture source and the upstream rainout on stable isotopes in precipitation – a case study in Nanjing, East China" (hess-2015-64) by* Y. Tang et al.**

Note: The reviewer's comments are in black, our replies in blue, and the changes in the text marked in red.

Reviewer#1

Interactive comment on "Effects of changes in moisture source and the upstream rainout on stable isotopes in precipitation — a case study in Nanjing, East China" by Y. Tang et al.

Tang et al. examined the isotopic variations in precipitation both monsoon and non-monsoon period in Nanjing, East China and aimed to explain control factor for those variations which is important for interpreting the stable isotopic composition of speleothems in the Asian monsoon region. In general, it is improved compare to the previous versions; but the two parts(monsoon and non-monsoon) was not combined as a whole to organize the whole paper, I think the paper of the manuscript still needs further improvements before publication because of following reasons.

- Major comments

First, the author should clearly differentiate the seasonal variations and inter-seasonal variations in the manuscript. From the Fig 4/5a, it is clear that the temperature effect is obvious in non-monsoon period, but in summer monsoon period, it seems that "amount effect" characterized by negative relationship between precipitation $\delta^{18}O$ and precipitation amount were also exist from three year observations, in spite of the isotopic amount effect cannot account for this variability in summer time . Therefore, the author should illustrate that properly in the whole manuscript.

The seasonal variations and intra-seasonal variations of stable isotopes in precipitation were clarified in the revision. See more details in the revision.

We agree with the reviewer that "amount effect" may exist on longer time scale. Indeed, there is a weak but significantly negative correlation between the monthly isotopic composition ($\delta^{18}O$ or δD) and precipitation amount at Nanjing during summers of 1987-1992 (data available from the Global Network for Isotopes in Precipitation (GNIP) at http://isohis.iaea.org/gnip.asp). This part was discussed in the revision.

Second, the author give explanations in detail for inter-seasonal variations during summer season, and point out that changes in moisture source location and upstream rainout effect is controlling factors for those variations. However, in this part, it is not quite pertinence to interpreting the stable isotopic composition of speleothems in the Asian monsoon region. Therefore, this part should be highly summarized. In addition, please add the isotopic background characteristics of each possible source area (e.g.

Bay of Bengal, South China Sea and inland area) in the Section of study area, which will benefit to understanding the variations in summer time. Or as suggested by previous reviewer, the purpose of this paper just mainly focuses on explaining the precipitations variations during summer time but not interpreting variations in speleothems.

We admit that the mechanism (i.e., effects of changes in moisture source and the upstream rainout on stable isotopes in precipitation) we discussed on intra-seasonal time scale may be not quite pertinence to interpreting the stable isotopic composition of speleothems in the Asian monsoon region on interannual to decadal time scales because changes in moisture source and the upstream rainout at the time scales may not be significant. Nevertheless, the mechanism could be important on longer time scale (centennial to orbital time scales), for instance the glacial-interglacial time scale when moisture source and the upstream rainout might vary remarkably. This part was discussed in the revision.

The isotopic background characteristics (seasonal variations of stable isotopes in the study area) were added in the Section of study area.

● Minor corrections

1) Line 15-16: Rainfall amount effect exists during the summer period, but rainfall amount effect cannot explain the inter-summer variations. Therefore, there sentence should be illustrating properly.

This sentence was revised according to the reviewer's comments.

2) Line 100-102: Those explanations should be appeared in section of Method and materials.

Changes were made accordingly in the revision.

3) Line 110-181: Please make the description of study area short and concise.

The Section study area was reorganized in the revision. See more details in the revision.

4) Line 110-181: How E was calculated, that should be mentioned here.

The evaporation (E) data of Nanjing was available from the China Meteorological Data Sharing Service System.

Reviewer#2

Summary

The revised paper is much improved from the original draft. Non-monsoon season precipitation is better dealt with, but future work, perhaps in another paper, could be done to assess the integrated signal produced by both monsoon and non-monsoon precipitation. The major concerns I had with the initial manuscript have largely been addressed and the manuscript is close to publication quality. The primary questions

that remain surround the cluster analysis of the HYSPLIT back trajectory data. I would like to see a more detailed explanation of how the cluster analysis was conducted. Frist, is this a feature of the HYSPLIT model, or were back trajectories exported and analyzed separately with different statistical software, like MATLAB? If the analysis was performed outside of HYSPLIT, what software was used. How was the total spatial variance calculated/derived? For the cluster analysis, of the back trajectories, were points along each trajectory included, or just the initial starting point for each trajectory?

Aside from these questions surrounding the HYSPLIT model, the manuscript is in good shape. More specific comments are detailed below. Once these are addressed, the manuscript will be fit for acceptance and publication.

The cluster analysis was conducted by the HYSPLIT model. The total spatial variance was calculated by the HYSPLIT model rather than other statistical software, and it was used to identify the optimum number of clusters. For the cluster analysis, all points along each trajectory were included.

Specific Comment:

Line 28 Change "put forward" to "proposed"

Changed.

Line 35 Change to "influenced"

Line 48 Change to "but are instead linked to rainout processes"

Line 67 Change "indicate" to "were related to"

Line 93 Delete "hereafter"

Line 94 Change "could" to "can"

Line 97 Change to "amounts"

Line 107 Change ="were" to "are"

Line 116 Change to "In the winter, air masses"

Line 152 Delete "source"

Changed.

Line 173 Add "(Fig. 3)" after "season." Delete "The simulated trajectories are presented in Fig. 3.

Changed.

Line 183 How was evaporation prevented and/or reduced? Was there a top of some sort? Was the container left out for 24 hours at a time? A little more detail about the collection of individual precip events would be good.

More details about the sample collection at individual precipitation events were added in the revision. See more details in the revision.

Line 186 Change "for storage in a freezer" to "and frozen"

Changed.

Line 198 How was instrument drift accounted for on the Picarro?

The maximum peak drift in 24 hours of Picarro L2120-i is less 0.6‰ for δ^{18}O and 1.8‰ for δD. To reduce the influence of the instrument drift on analytical accuracy, internal water standard samples were inserted among the samples (one water standard sample for every 7 samples) for measurement.

Line 208 Delete "In detail"

Changed.

Line 231 -233. This sentence is confusing and should be re written.

This sentence was re-written in the revision.

Line 235 -236 How does the Meiyu have different start dates? Do you mean just periods when the Meiyu is active?

In general, the start date of Meiyu is defined by precipitation amount, duration of precipitation and spatial scale of precipitation. Thus, the start dates of Meiyu are different in different years.

Line 301 Insert "the" between "with" and "ITCZ"

Changed.

Line 327 Does local here refer to Nanjing?

Yes.

Line 355 Change "from" to "transport to"

Changed.

Line 357 Insert "This is consistent with…" at the start of the sentence.

Changed.

Line 372 Change "no" to "not"

Changed.

Line 377 Change "in the" to "within"

Changed.

Line 377. It's not just convection in the moisture source, but changes in which region is the moisture source is also an important factor controlling changes in δ18Oprecip. This should be clearly stated since it is clearly one of the findings here.

We agree with the reviewer. Changes were made according to the reviewer's comments.

Line 379 Delete "Results are shown in Fig. 10." Sentences like this should be avoided.

Changes were made accordingly in the revision.

Line 386 Change "confirms" to "supports"

Changed.

Line 408 Again, changes in the moisture source, not just convection, appear to be important in controlling δ18Oprecip.

We agree with the reviewer. Changes were made according to the reviewer's comments.

Line 430 Delete "the" after "How"

Changed.

Line 443 Change "Anyhow" to "Regardless"

Changed.

Line 448 Do not begin a paragraph with "As a result"

Changed.

Line 460 Can you include the figure as a supplemental figure? This sentence also need to be rewritten for clarity and grammar.

We calculated the correlation between the annual mean weighted-precipitation $\delta^{18}O$ and the ratio of summer to winter precipitation based on the combination of our observation (2012-2014) and GNIP data (1987-1992) (Fig. S1). The years with more than two months of missing data were excluded from analysis, and they include 1987, 1991 and 2013. This sentence was re-written in the revision.
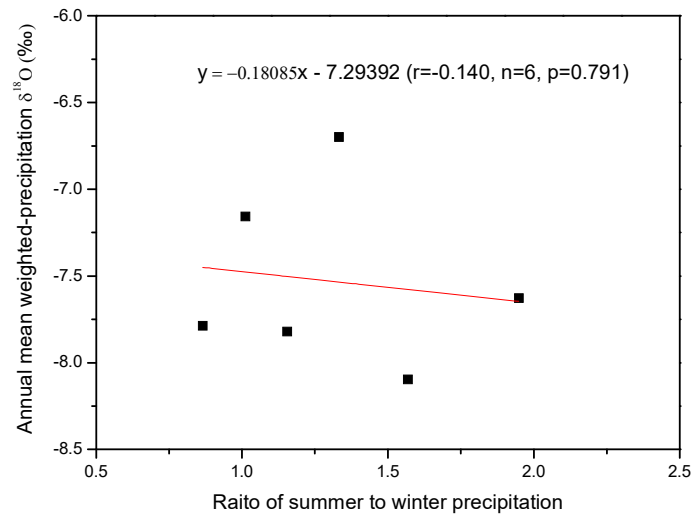
y = −0.18085x - 7.29392 (r=-0.140, n=6, p=0.791)

Fig. S1. Correlation between annual mean weighted-precipitation $\delta^{18}O$ and ratio of summer to winter precipitation in Nanjing.

Line 470 Incorrect use of "emphatically"

Changed.

Line 472. It seems like changes in moisture source and convection in moisture sources were found to be the primary drivers of δ18Oprecip, not as much ITCZ.

We agree with the reviewer. Changes were made according to the reviewer's comments.