Clim. Past Discuss., 10, C2138–C2145, 2014
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Climate of the Past Discussions

Interactive comment on "Atmospheric circulation controls on the inter-annual variability in precipitation isotope ratio in Japan" *by* N. Kurita et al.

N. Kurita et al.

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Dear Reviewer #1

I'm grateful for through evaluation of my work provided by the two reviewers of the original submission. I have accepted all of your comments, and following your suggestions, manuscript has been extensively revised.

Among the most significant changes made to conclude that the intensity of the East Asian Monsoon (EAM) is the primary driver of variations of Japanese precipitation. East Asian Monsoon is a one of great concern for paleoclimatologists, and our findings lead to that the isotope proxy records in Japan can be used to reconstruct the past

EAM. This is an improvement in isotope proxy interpretation in Japan. So that we think the subject of this study is within scope of the CP. The revised manuscript was attached as supplement.

Here I describe my reply to your comments.

List of major revisions:

1. This revised manuscript has been largely reorganized and rewritten to show that the isotope variations in Japanese precipitation reflect the intensity of East Asian summer and winter monsoon. Unlike China, the seasonal isotopic variation in Japanese precipitation is less sensitive to the monsoon precipitation. Thus, we cannot apply the interpretation for Chinese spelepthem delta-O to Japanese stalagmite. To reconstruct the past EAM from isotope proxy records in Japan, first we have to clarify the relationship between the isotopic content in Japanese precipitation and the EAM. Through this study, we demonstrate that the intensity of the EAM is the primary driver of variations of Japanese precipitation, and this finding would lead to improve the proxy interpretation in Japan. Thus, we think the subject of this study is within scope of the CP.

2. To explain how useful our study to paleoclimate study, we added a new "motivation" subsection in Introduction and added new Figure 1.

3. Section 5 and several Figures were removed, and then the new discussion to show how the EAM variability influences the isotopic composition in Japanese precipitation and Figure 10 were added.

Reply to your minor comments

Page 3991, Line 3: "Among other materials, these records ..." Please explain, what you mean by other materials that influence the isotope records.

Response : This sentence was removed from this revised manuscript.

P3392, L5: a reference is missing

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Response: This sentence was removed from this revised manuscript.

P3993, L1: please reformulate “In contrast from the tropics, historical... “ – This reads as no tropical GNIP data from tropical exists, at all.

Response: This sentence was removed from this revised manuscript.

P3993, L16/17: “we can say that isotopic variation in mid-latitude precipitation is not directly controlled by temperature and precipitation amounts” – this statement is true for intra- and inter-annual variability, only. Please reformulate this phrase.

Response: I agree for large-scale atmospheric circulation, but Berkelhammer et al. (2012) and Treble et al. (2005) and others have shown a clear isotopic variation in response to synoptic-scale atmospheric circulation. So, I remove a word “large-scale” from this sentence.

P3996, L13: What is meant by “internal and external variations”?

Response: Internal variation means that the variation originate from the measurement instrument. External variation means that the variation including the error stemming from the preparation system. Escape from confusion, we removed this phrase.

P3996, L15: Please explain how uncertainty for Deuterium excess values ($\pm$2.1‰ has been determined. From the given uncertainty values for d18O and dD, one would expect a larger value for d-excess.

Response: Thank you for your careful check. This is a careless mistake. The correct value is 2.6 permil for the uncertainty of d-excess. Thanks!

P3996, L23: please insert “... by the same method as for precipitation samples.”

Response: Done.

P3998, L19: 24h back trajectories seem rather short for as an indicator of cumulative rainfall before arriving at Nagoya site. Please explain this choice in some more detail.

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Response: Japan is island country and is surrounded by warm ocean current. Because spatial isotopic variation in marine moisture near around Japan is quite small (Kurita, 2013 and unpublished data), we assumed that the isotopic content of source water fed into a precipitating system is homogeneous and calculated cumulative rainfall while air mass passes through precipitating area associated with a low pressure system. As shown in attached Figure, The 24 hours is enough time that air mass travels from warm oceanic region to the site through a precipitating system. This information was added in the revised manuscript.

P3999, L5: "Because trajectories do not travel far away from Japan, the major source of uncertainty for cumulative rainfall is related to the quality of the precipitation field data, rather than the trajectory uncertainty." This is an important finding for the analyses and should be explained in some more detail. E.g. how many trajectories have been analyzed for each event? What distance is meant by "not far away from Japan"? I recommend that the authors add one extra figure showing examples of the reconstructed trajectories using HYSPLIT.

Response: We calculated cumulative rainfall while air mass pass through a subsynoptic scale precipitating area. Attached Figure shows that there is small-scale precipitation variability, and this demonstrates that high temporal and spatial resolution precipitation data is necessary to obtain precise cumulative rainfall. On the other hand, because the duration of the back trajectory is short, I think that the trajectory uncertainty may be limited. However, I think this overstates. In the revised manuscript, we removed this sentence and just pointed out the importance of resolution of precipitation field data. Because graphical representation how to calculate cumulative rainfall using HYSPLIT is too complicate, and this is not main topics of this study, we did not add the extra Figure. Q1: How many trajectories have been analyzed for each event? A1: Trajectories were launched from 9 different points at every hour. Total number of trajectories for a precipitation event depends on how long precipitation is prolonged at the site. Q2:What distance is meant by "not far way from Japan"? A2: Trajectories do

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not fry away from the coverage area of radar-AMeDAS (3600 km x 2880 km).

P4000, L26: “Unclear seasonality” – please change to “Weak seasonality”

Response: Done

P4001, L15: Please insert “These findings suggest that...”

Response: Done

P4001, L20: Delete “with relatively the higher (lower)...”

Response: Done

P4001, L25: Please correct “sub-synoptic scale rain fronts forms between...”

Response: Done

P4002, L29: Please use the same sample label in Fig. 6a and Fig.5

Response: Done

P4004, L13: Omit the comma in “We further examined...”

Response: Done

P4005: The beginning of Chapter 4 “Inter-annual isotopic variation” starts with (too) many redundant information already given earlier and can be shortened.

Response: We removed this sentence.

P4005, L16: Please correct “while air mass the traveled through...”

Response: Done

P4005, L24: Please give some more detail about the replaced of local precipitation amount by area-averaged precipitation amount. Which area has been considered? How is this area related to the extent of the trajectories used for the prior calculations of cumulative rainfall amount?

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Response: As described in Section 2.4, trajectories were launched from 9 different points around the observation site (0.5°x0.5°) at hourly interval while rainfall was sustained. We observed a good correlation between cumulative rainfall along the 9 hour trajectories and the cumulative rainfall at 0 hour trajectories (0.653), and this means that variability in cumulative rainfall in Japan depends on the duration of precipitation event. In addition, prolonged precipitation occurs during the passage of large-scale precipitating systems. The reason why we used area-averaged precipitation is to reduce the contribution of local rainfall induced from local convection, which is characterized by heavier delta-D values. The influence of local precipitation disturbs the trend of precipitation amount with duration time.

P4008, L16: Please correct “to the years when the isotopic content”

Response: Done

P4009, L7: The statement “The expectation was for a correlation between d18O variability and ENSO through the PJ pattern” sounds awkward – please rephrase it.

Response: We removed the “Discussion” section.

P4009, L9: Please change “The reason is believed to be...” to “The reason might be...”

Response: We removed the “Discussion” section.

P.4011, L7: Please delete “at the multiple temporal scales.”

Response: Done

P4011, L8: Please correct “less seasonal variations” to “minor seasonal variations” or similar

Response: Done

P4012, L12: Please insert “These results indicate that...”

Response: Done

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P4012, L24: I suggest to use the term “isotopic variability of mid-latitude precipitation” instead of “isotopic composition” as this describes much better the presented results

Response: Done

Fig. 4: Did all precipitation events have the same duration? If not, how much did they differ? Please include this piece of information in the plot or manuscript.

Response: The 24-hours cumulative rainfall was used for Figure 4. This information was added in both Figure 4 and manuscript.

Fig. 8: Why has GPCC precipitation data instead of GNIP precipitation data been used in this figure? Do large differences in both monthly precipitation data sets exist?

Response: GPCC was used to obtain area-averaged precipitation amount (1°x 1°). Because large improvement of the delta-D – precipitation relationship was observed when the local precipitation amount is replaced with area-averaged precipitation (0.5°x 0.5°), we assumed that area-averaged precipitation could be used as a substitute for cumulative rainfall. During summer, shower rainfall associated with local convection occasionally occurs and thus local monthly precipitation is not identical to area-averaged precipitation.

Fig. 11: Please use the same map projection for Fig.11a and Fig.11b.

Response: Fig 11a is removed from the revised manuscript.

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/10/C2138/2014/cpd-10-C2138-2014-supplement.pdf

Interactive comment on Clim. Past Discuss., 10, 3989, 2014.

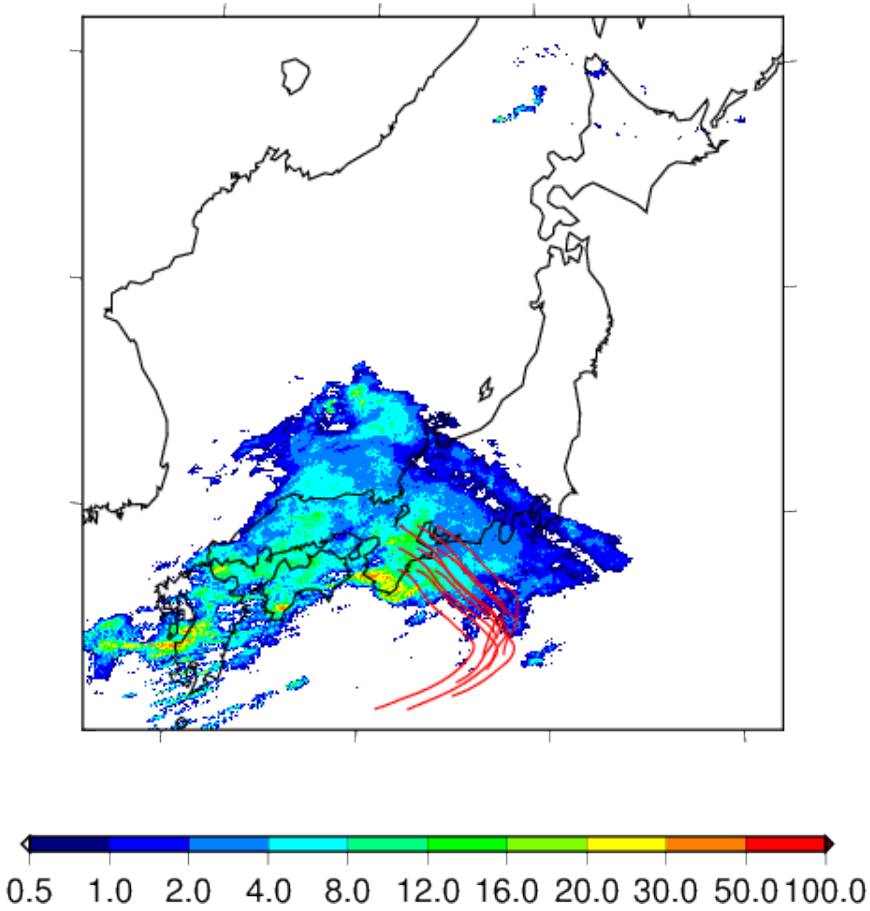

Fig. 1. 24-hours back trajectories from 9 different points around Nagoya station and precipitation intensity [mm/h] delivered from Radar-AMeDAS data at 00 UTC 26 June, 2013.

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