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Interactive comment on "Quantitative reconstruction of precipitation changes on the NE Tibetan Plateau since the Last Glacial Maximum – extending the concept of pollen source-area to pollen-based climate reconstructions from large lakes" *by* Y. Wang et al.

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We would like to thank Dr. Guiot (editor), Dr. Giesecke (referee) and one anonymous referee for their constructive comments and suggestions which improved our manuscript.

Dr. T. Giesecke (Referee #1)

The manuscript contains interesting methodological aspects on climate reconstructions using pollen based transfer functions and ordinations. The authors address taphonomic effects on the pollen composition in the training set caused by lake size and the effect of within lake differences in pollen composition on the reconstructed values. The source area of 50% pollen for the major taxa is used to link the climate signal to the area generating the pollen signal, which may help in particular where surface samples from different lake sizes are used together. These new concepts are applied in a reconstruction of precipitation from pollen data of a large lake on the NE Tibetan Plateau and in conjunction with previous results provide an improved late Quaternary history for that region.

Specific comments

P.3579, L. 7-8: I do not understand the validation of the pollen data with ostracod data from the same site showing different trends through time in ordination space. Also the pollen data from Lake Kuhai is not revealing a strong pattern that would "validate" the patterns in this pollen dataset. Although, I agree in general that a multi-proxy or multi-site approach is adding confidence or different aspects of climate variability, I do not see a "rigorous validation" here. The comparison of the precipitation reconstruction with two nearby lakes (Fig. 8, P. 3586, L. 4) is more convincing. Thus may be the procrustes analysis is not the best method to support the argument in this section.

Our response: Here our validation indicates generally that pollen records are more suitable for climate reconstructions than the aquatic proxies (ostracod), and a multi-site comparison will also increase our confidence. The phrase "rigorous validation" might be a little misleading; we have changed the phrase to "multi-proxy and multi-site validation".

P. 3587, L. 19: This is somewhat circular. You used a model which is known to indicate a larger source area for larger lakes. You affected that relationship somewhat by weighting the 50% source area according to species composition, but the initial

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relationship is still there.

Our response: We agree and have removed such sentences.

Technical comments

P. 3567, L. 10-14: This sentence mixes two important concepts: 1) Pollen source area depends on lake size (note differences in the why between Tauber 1965 and Prentice 1985). 2) Due to species specific characteristics in fall speed the pollen source area should vary between species.

Our response: Revised, we have separated these concepts as following: “The inferred size of this source area, however, can vary with the size of the lake basin as well as the species-specific pollen dispersal and depositional characteristics (Tauber, 1965, 1977; Janssen, 1966, 1973; Anderson, 1970; Jacobson and Bradshaw, 1981; Parsons and Prentice, 1981; Prentice, 1985; Schwartz, 1989).”

P. 3567, L. 18: Sugita (1993) has not just calculated the source area for 50% of pollen with different fall speed but provided graphs from his numerical model illustrating the source area for different proportions depending on fall speed and lake size.

Our response: Sugita (1993) has presented the method to calculate the pollen source-area, but did not give an exact value for the calculation. Here we just followed his calculations in the paper, using 50% to define the size of pollen source-area.

P. 3575, L. 24 and elsewhere: I suppose CP as an online journal has no size restriction so some or all supplementary material may be presented in the article itself.

Our response: Generally, we have many figures in our manuscript, and would like to put those ones with less importance in the supplementary, which will also be online access.

P. 3577, L. 25: Two samples fall into LSG 2.

Our response: We have added such information.

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P. 3581, L. 10: “proved” may be a bit strong here considering the small sample size.

Our response: We have replaced the word “proved” by “reported”.

Fig. 5: The triangles should be labeled or may be omitted.

Our response: We have added the labels, which stand for the pollen taxa.

Anonymous Referee #2

This is a very interesting study in which the authors address the influence on lake size (and therefore pollen source area) on paleoclimate reconstructions. The paper is generally well designed and written, and there are some very informative results. For example, the comparison of surface samples from neighboring small and big lakes (to show difference in taxa representation) is very useful. However, there are several parts that could use some clarification. I can’t help wondering if the paper might be improved by concentrating on the effect of including lake size, and leaving the discussion of the reconstruction and its regional significance for another paper. Given that the goal is to show how using pollen source are improves reconstructions, why is there no comparison with paleoclimate estimates made without taking source area into account? Without this, it is hard to judge how much bias is introduced by not accounting for lake size, and so if the extra work involved in this study really helps in reconstructing climate.

Our response: We have now performed the WA-PLS method using the climate data without considering the effect of pollen source-area. As we already observed that the inverse distance weighted mean annual precipitation is generally higher than the data without considering the PSA (Fig. 4a), the reconstructed precipitation with considering PSA are around 30 mm higher that the reconstructions without consideration of PSA (Fig. S5).

The authors use a battery of statistical methods to examine source area and pollen climate relationships. Well these are well described, the paper might benefit from a short introduction in the methods section, explaining why these methods have been

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chosen and what they are being used for. For example, why do the authors use two methods for reconstructing past climate? And how much difference is really observed between these methods?

Our response: We have presented a table to describe our purposes of the statistical methods (Tab. 3). And, the reason of two reconstruction methods is that our MRT/RDA method could only yield semi-quantitative reconstructions, and WA-PLS could provide us a quantitative record to compare with other records. Also, it is hard to compare the reconstructions from these two methods as one is only semi-quantitative.

Some general comments follow:

Page 3565, lines 1-3: It is not clear to me how "species-specific variations in pollen dispersal patterns" are connected to lake-size. I agree that these variations will affect reconstructions, but how are these linked to lake size?

Our response: As for different pollen taxa, the size of the pollen grains are different, such differences will lead to different dispersal patterns. Generally, smaller grains are more easily transported than those larger ones. Then, if one lake is large enough, the smaller pollen grains are more easily transported to the lake center than those larger ones, which show the influences from the lake size.

Page 3566, lines 11-12: While the study of past climates helps inform future changes, I'm not sure that it is an "indispensible key for predictions"

Our response: We have removed this statement.

Page 3567, lines 15-16: I realize that this will be stated in other papers, but please add a line to explain why estimating deposition in the center of a basin is not suitable for lake sediments

Our response: The reason is that, the pollen deposition in lakes could be further mixed in the water column, which is not the case in peat depositions. We have added such information in the text.

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Page 3570: Can the authors include an equation detailing how pollen source areas are estimated, and what parameters are included?

Page 3570, line 29: Given that different taxa show different source area relationships with a given lake size, how was the final pollen source area derived?

Our response: Sugita (1933) has developed generally the basis for the calculations of pollen source-area, but not giving the detailed method to maintain such multi-taxa calculations. We have simply weighted the size of source are for each taxa by their proportions in the total pollen assemblage. Expressed by an equation, it could be: PSAlake = PSA1*Per1+PSA2*Per2+PSA3*Per3+PSA4*Per4 PSAlake stands for the pollen source-area of the lake, PSA (1-4) indicate the size of pollen source-area for each taxon, and Per (1-4) are the pollen proportions for each taxon.

Page 3571, line 14-15: This is where the effect of lake size (and source area) is taken into account, and a little more detail would be useful. Why was IDW used? Climate would normally be interpolated from climate stations to a surface samples, so how does IDW change the final value assigned? And how would this differ from a direct interpolation from climate stations?

Our response: Here, considering the dispersal process of the pollen grains, within the pollen source-area, the vegetation closer to the lake would have much higher contributions to the pollen assemblages in the lake depositions than the vegetation close to the boundary of the pollen source-area. In this case, the climate data from the locations close to the lake would also have stronger influences than those are far away, and thus, we applied such Inverse Distance Weighting method to the climate data.

Page 3572, line 27-28: Can the authors provide a citation for the “minor influence” of rare species?

Our response: Revised, we have added such reference.

Page 3573, line 17-19: Given that linear methods were indicated here, why did the

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authors use WA-PLS for reconstructions?

Our response: The DCA analysis for our modern large lake surface pollen dataset yields a 1.78 SD, which is also suitable for the unimodel methods. We have applied the RDA/MRT method for climate reconstruction, from which we could only get semi-quantitative results. For comparison and for a quantitative reconstruction, we also applied the WA-PLS method.

Page 3574, line 19: Why were these variables selected (Pann, Tjul)? Why not seasonal precipitation?

Our response: The variables were selected by RDA and MRT analyses. And, according to the previously work in the Tibetan Plateau as well as the arid western China by our group members (Dr. Ulrike Herzschuh and Dr. Jian Ni), seasonal precipitation does not work so well as the mean annual precipitation, which was not included.

Page 3575, line 1: How where the samples resampled to a regular time step? Interpolation? Averaging?

Our response: It is kind of interpolation method.

Page 3575, line 4: By restricted permutations, do the authors mean block resampling?

Our response: Yes, it is kind of block resampling.

Page 3579, line 25: The authors note that variations in lake size through time will have an effect on climate reconstructions, but in this article they do not look at size variation over time. I believe the implication is that the lake, which is steep-sided, will not have changes area much over the time period of study, but it would be nice to have the authors explain this, or how they might try to include time-dependent effects of lake area variation

Our response: We were aware of such variation in lake size through time, as well as the potential influences. However, it seems to be too complicated at the present stage

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to include this in the climate reconstructions. We might be able to find solutions in the future work, but not in this manuscript.

Page 3580, line 1: I don't think that it is true that changes in the pollen composition "have rarely been considered when inferring quantitative climate variations from lake-pollen records" – any reconstruction method must do this.

Our response: We have removed such statement.

Page 3580: Why is Tann not reconstructed or discussed here?

Our response: We have included Tann in the preliminary analysis, which was not selected by the RDA/MRT analysis but Tjuly.

Page 3580: It would be very informative to compare the reconstructions with the lake area taken into account, with a standard reconstruction (or just compare the climate for the source area with a point estimate of climate)

Our response: We have now performed the WA-PLS method using the climate data without considering the effect of pollen source-area. As we already observed that the inverse distance weighted mean annual precipitation is generally higher than the data without considering the PSA (Fig. 4a), the reconstructed precipitation with considering PSA are around 30 mm higher that the reconstructions without consideration of PSA (Fig. S5).

Page 3581, line 13: I think this figure 8c not 8d

Our response: Revised

Page 3587, line 15: change "minimize" to "reduce"

Our response: Revised

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/9/C2062/2013/cpd-9-C2062-2013-supplement.pdf

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