

Interactive comment on “Quantitative reconstruction of East Asian summer monsoon precipitation during the Holocene based on oxygen isotope mass-balance calculation in the East China Sea” by Y. Kubota et al.

Anonymous Referee #2

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General comments By adding sixty-seven planktonic foraminiferal Mg/Ca and $\delta^{18}\text{O}$ data points to the records previously published by Kubota et al. (2010), the authors provide high-resolution data sets of *G. ruber* Mg/Ca and $\delta^{18}\text{O}$ over the Holocene that was obtained from a marine sediment core KY in easternmost East China Sea. Assuming that surface seawater $\delta^{18}\text{O}$ at site KY was determined by a binary mixing of a freshwater end-member originated from Changjiang River and an oceanic end-member (mixture of Kuroshio surface water (KSW), Kuroshio subsurface water (KSSW) and Tsushima Strait water (TSW)), the authors calculate the proportion of Changjiang river

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water in the surface water at the core location (fCFW). The change in fCFW is interpreted as variable Eastern Asian summer monsoon (EASM) precipitation. The main conclusion is that local summer insolation was not a dominant factor controlling the EASM precipitation for the last 7 ka, which is the opposite of the general consensus.

I believe that the authors provide high-quality data that have significant importance. However, I am not convinced by the robustness of authors' interpretation. I develop my argument below.

1) At site KY, surface water $\delta^{18}\text{O}$ is mainly determined by the oceanic end-member. The estimated fCFW is only 0 to 5% for the last 7ka. Furthermore, the binary mixing model contains numerous assumptions (ex. since the KSSW $\delta^{18}\text{O}$ record for the last 7 ka does not exist, the KSSW $\delta^{18}\text{O}$ values are deduced from a KSW record assuming a constant offset between KSSW and KSW; TSW $\delta^{18}\text{O}$ is estimated from the result of one core of which only two intervals were dated by ^{14}C ; The mixing proportion of KSW, KSSW and TSW is supposed to be constant for the whole studied period; The cave temperature is also supposed to be constant, and under this condition the $\delta^{18}\text{O}$ values of the freshwater end-member are calculated). The authors consider uncertainty related to Mg/Ca-SST estimate to evaluate the error of fCFW. Since each assumption adds distinct uncertainty to the fCFW estimate, it is not certain that the small proportion of the river water contribution is always significant when all the uncertainty is propagated. This point should be examined.

2) The changes in fCFW are interpreted in terms of the past EASM precipitation variability. But other factors, such as monsoonal winds, might have significant influence to the Changjiang river water advection. As authors state in modern climatological settings, stronger southerly wind could enhance the eastward extension of Changjiang diluted water, leading to higher fCFW values even if Changjiang river discharge is invariable. Such alternative possibility should be discussed.

3) It is not clear for me whether the centennial to sub-millennial scale variability of fCFW

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(Fig. 8) is real and correctly estimated. The authors average and smooth $\delta^{18}\text{O}$ values of three oceanic water masses (KSW, KSSW and TSW) because the three records do not show similar variability (Fig. 6). The difference between KSW, KSSW and TSW $\delta^{18}\text{O}$ records is explained by “large analytical error, local variability of precipitation/evaporation, or large error in $\delta^{18}\text{O}$ attributable to heterogeneity of the samples”. Due to averaging and smoothing, centennial to sub-millennial scale variability of $\delta^{18}\text{O}$ records of the oceanic end-member is erased (Fig. 7) whereas the centennial to sub-millennial scale variability of the surface water $\delta^{18}\text{O}$ record at site KY is maintained. Does the high frequent variability of fCFW remain even if the smoothing of the oceanic component is omitted?

4) I do not understand the interest of flux estimate (section 4.4) by adding further hypotheses. The flux variability (Fig. 10) and fCFW changes (Fig. 8) are virtually the same.

5) Except for the El Niño record by Moy et al. (2002), there is no comparison between fCFW and other EASM records, time series of forcing (ex. solar insolation, solar activity) and modelling results. This lack makes difficult to evaluate the robustness of the authors’ main message.

6) It is possible that speleothem $\delta^{18}\text{O}$ records cannot be totally explained by summer monsoonal intensity. However, modelling studies also indicate the influence of solar insolation on the EASM intensity (ex. Liu et al., 2003; Kutzbach et al., 2008). Consequently, it seems difficult to justify the different EASM intensity evaluated by this study and speleothem records only by the bias of speleothem $\delta^{18}\text{O}$ records. Indeed, the authors do not give any explanation about the absence of long-term trend of Changjiang river water discharge.

Taken together, I suggest whole revision of paper including re-evaluation of propagated uncertainty of fCFW, comparison with possible forcing, other reconstructed time series and modelling results, and explanation of the insensitivity to the local insolation. It is

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necessary to clarify the absence of local insolation effect is a local feature or a more regional trend.

Minor or specific comments The title of the paper would be modified because the reconstruction is not really quantitative taking into account the uncertainty.

In the introduction, the authors focus on possible bias of speleothem $\delta^{18}\text{O}$ records as indicators of the EASM intensity. In contrast, they concentrate on ENSO influence in discussion section. The manuscript should be reorganized to be consistent.

P. 1449, lines 14-15. Introduction. The authors state that the tight linkage between the intensity of EASM and local summer insolation on orbital timescales is based on the speleothem $\delta^{18}\text{O}$ records. This is not true because modelling studies also indicate the influence of solar insolation on the EASM intensity (ex. Liu et al., 2003; Kutzbach et al., 2008).

P. 1450, lines 4-7. The variation of compiled lake level records within Changjiang Basin might be compared with fCFW (Fig. 8).

P. 1450, line 12, “CDW”. Please define this word at the first use.

P. 1450, lines 11-13. The calcification depth of *G. ruber* is estimated to be upper 30 m in this study. Did the author distinguish different morphotypes of *G. ruber* sensu strict and sensu lato? Since *G. ruber* (s.s.) calcifies indeed in the upper 30m but *G. ruber* (s.l.) calcifies below 30 m (Wang, 2000), only *G. ruber* (s.s) should have used in this study.

P. 1456, line 7. “For core KY core,” should be “For core KY”.

P. 1457, line 2. “from11.6 to” should be “from 11.6 to”.

P. 1461, line 3. A reference (Chen et al., 2010) is missing in the reference list.

P. 1464, line 24. “four data set” should be “four data sets”.

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P. 1465, lines 5-16. The authors use speleothem $\delta^{18}\text{O}$ record of Heshang Cave to estimate $\delta^{18}\text{O}$ of Changjiang fresh water. They indicate that the Sanbao Cave $\delta^{18}\text{O}$ record gives consistent results. How about the estimate based on the speleothem record of Dongge cave shown in Fig. 1?

P. 1467, lines 19-29. The salinity data for the period 1985-1990 was deviated from a general trend because of the decrease in salinity of the end-member. The interest here is why the salinity of end-member declined for this period.

P. 1467, line 29-P. 1468, line 1. The data for period 1996-2000 is omitted due to a large annual variability. Again, why the annual variability was abnormally large?

Fig. 6. Please indicate raw data points of *G. ruber* Mg/Ca and surface water $\delta^{18}\text{O}$ of each record in addition to running average curves and/or temporal resolution of original data sets in the figure caption. This information is helpful to judge whether different centennial to sub-millennial variability observed for each core is related to its temporal resolution. Please indicate age control points for core 2904.

Reference. Chen et al., 2010 and Wang, 2000 are missing in the list.

References Kutzbach, J.E., Liu, X., Liu, Z. and Chen, G., 2008. Simulation of the evolutionary response of global summer monsoons to orbital forcing over the past 280,000 years. *Clim. Dyn.*, 30: 567-579. Liu, Z., Otto-Bliesner, B., Kutzbach, J., Li, L. and Shields, C., 2003. Coupled Climate Simulation of the Evolution of Global Monsoons in the Holocene*. *J. Clim.*, 16(15): 2472-2490.

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