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Climate of the Past Discussions

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Interactive Comment

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.

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We are grateful to the reviewer for recommending publication in the special issue and valuable suggestions to improve quality of our paper. The following is our reply to queries and comments raised.

Abstract:
1. Line 20; not clear what is written. . . indicates no longer term decreasing trend in river discharge. . .. I think the authors mean, no long-term (secular) trend in

Changjiang River Q. »We mean "the record of the freshwater contribution does not show a gradually decreasing secular trend from middle Holocene to late Holocene". We will revise this sentence so that above meaning becomes clear.

2. Suggest delete last sentence of abstract (lines 24-26) as this sentence does not add much and distracts from the main conclusion in the sentence just before. » We will delete the last sentence as is suggested.

Paper:
1. The SSS climatology for the KY core site indicates a 1.7 salinity unit annual cycle with the SSS minima occurring in July. However, the July SSS spatial pattern shown in Figure 4 indicates that the diluted Changjiang River plume does not clearly reach the KY core site. What is the possibility that SSS at the core site is related or in-part related to Kuroshio Current dynamics. » Inoue et al. (2012) reported that the Changjiang freshwater reach near the core site at modern condition based on 226Ra, 228Ra, and 228Th activities in the surface water at the site, which supports our interpretation that SSS of the site has been influenced by Changjiang River discharge. Moreover, the Kuroshio transport is greater in summer than in winter in the East China Sea at present. Nevertheless, SSS at the core site is lowest in summer, indicating that the Changjiang runoff dominates over the Kuroshio transport. Thus, we think the main control on SSS in the core site is the freshwater from Changjiang River.

2. The timing of the small century scale changes in Mg/Ca upper 30m temperatures does not agree between the cores KY and A7 (the next closest) to the south of KY. The century-scale temperature variations they observed in core KY are largest (1.5-2âŮęC) between 3.8-5Kyr, otherwise they are small and irregular. I think it is a stretch to define the series of "cool" events now defined on page 1456 (lines 24-26) given the +/- 0.3âŮęC precision and the non-reproducible Mg/Ca temperature changes between at least cores KY and A7. » Thank you for your advice. We agree that it is a stretch to define the warm or cool "events" because our SST variations in centennial to millennial scale do not agree with those of A7 or other southern sites. However, we believe that

this inconsistency is due to the difference in water masses that affect the two core sites, the difference in time resolution achieved, and/or uncertainties of age models. Temperature of the Changjiang diluted water, one end-member, is lower (19-25°C) than that of the Kuroshio surface water (27-29 °C), another end-member, (Zhang et al., 2007). The influence of the Changjiang diluted water is very low in A7 site where the Kuroshio water has larger influence. On the other hand, the Changjiang diluted water has a large influence on inter-annual variations in SST and surface δ18Ow at KY site. Therefore, we think the inconsistency in SST records between the northern and southern East China Sea could be explained by the difference in water masses that affect each core site. Besides, time resolution of the records of A7 is 120 yr, on average, which is roughly a half of ours. Taking into account of the reviewers comment, we will not use "cool event" or "warm event" in the revised manuscript, instead we will describe our record as follows. "SSTs were cooler by more than 1 σ error (0.45 °C) at 8.7, 8.2, 7.1-7.0, 6.1-6.0, 4.6-4.8, 3.6-3.5, 3.2, 2.8-3.2, 1.6, and 0.5 ka, while they were warmer by more than 1 σ error at 9.9, 9.7-9.6, 9.4, 9.0, 8.0-7.9, 6.7, 6.5, 4.9-5.1, 4.5-4.1, 3.8, and 0.8-0.7 ka".

3. The Changjiang River discharge data for Datong station shows increases during most El Nino events (see 1997, 1982, 1972, 1953). However, the proposed link to the Moy et al., low frequency El Nino record spanning the last 10Kyr is not convincing in my opinion. I suggest removing this aspect from the manuscript. There have been a lot of questions about a direct El Nino interpretation of the Moy record and given the mixed ENSO/monsoon signal in the Changjiang River basin, the comparison to the Moy record does not add much value to the paper and in my view raises more uncertainty issues. » Thank you for the suggestion. We agree with your comment. The comparison part with Moy et al. will be removed in the revised manuscript. Instead, we will devote some pages to comparison with other monsoon proxies to articulate implication(s) of our data.

4. Also, why has the upper 1,500 years of the d18Osw record from core KY been

removed from the data series shown in Figures 7, 8 and 10? » For a calculation of the relative contribution of the freshwater, we use δ18Ow data from the southern East China Sea sites including A7. However, the δ18Ow data from 1.5 ka to present are missing in A7 record of Sun et al. (2005), so we did not show this part. In the revised manuscript, we will present a time series of the relative contribution and flux of the Changjiang freshwater for the last 1500 yrs based on a calculation assuming that δ18Ow values of the end-member of the Kuroshio-Taiwan Water are the same as today.

Summary:
1. 1 (P1471 lines 19-23): where is this conclusion discussed in the text? It is important and needs discussion in its own section. I apologize if I just missed it, but after scanning the text I could not find where this is discussed expect in the abstract and summary. Strongly recommend that you add a section supporting this conclusion in a separate titled section. » We apologize that we did not include the discussion on this conclusion in the previous manuscript. We understand that there was a lack of explanation to conclude that "changes in summer insolation in the Northern Hemisphere did not mainly control the changes in summer precipitation in the South China". Therefore, we will add a section in the discussion chapter as Section "5.2. Regional dissimilarity of the Holocene optimum precipitation", in which we compare our results to other proxy records in China and model results. The stronger boreal summer insolation in the Northern hemisphere in the early to middle Holocene compared to today is believed to have enhanced EASM precipitation, which are supported by modeling studies (e.g., Kutzbach et al., 2007). In contrast, a recent transient simulation study for the Holocene revealed the complexity of the response of the Asian summer monsoon system to the Holocene insolation change (Jin et al., 2014). For example, the northern area (northern China, southern Mongolia) and southern area of the EASM (southwestern and southern China) could have higher precipitation than today in the early to middle Holocene, while the central and eastern area of the EASM (middle reaches of the Yangtze River (Changjiang) Basin, Korea, and Japan) could have less

precipitation. This dissimilarity is attributed to internal feedbacks within climate system, such as the air-sea interactions associated with the El Nino/Southern Oscillation and shift of the Inter Tropical Convergence Zone (Jin et al., 2014). Our δ18Ow record and estimated flux of the Changjiang freshwater show no apparent long-term trend from the middle Holocene to present-day, suggesting that temporal changes in the EASM precipitation in the Changjiang Basin do not follow the Holocene insolation pattern that monotonically decreases. In contrast, there are evidences that suggest decline in EASM precipitation from early/middle Holocene to present-day in other EASM areas (Zhang et al., 2011). This dissimilarity suggests that the insolation is not the only major factor but the internal feedbacks mentioned above could be also important to control the spatio-temporal pattern of EASM precipitation as suggested by the model results (Jin et al., 2014). For example, internal feedback may have caused movement of the westerly jet and expansion of the subtropical high in the western North Pacific, which, in turn, may have caused changes in the northward migration speed of the monsoon front and associated summer precipitation in the Changjiang Basin.

2. Figure 2; why not also plot total annual average discharge (Q). Figure 5: an age-depth x-y plot would help readers evaluate the sedimentation rate changes in the core. » We will add a plot of total annual average discharge in Figure 2 and age-depth plot as a new figure as are suggested.

Other edits: 1. p. 1454 line 4, crashed should be changed to crushed. »It will be changed as suggested.

2. p. 1469, Line 21 ; Should read El Nino events and not ENSO events. »Thank you for pointing this out. However, we omit the discussion on comparison with Moy et al.'s data.

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