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Interactive comment on "Multiproxy reconstruction for Kuroshio responses to Northern Hemispheric oceanic climate and Asian Monsoon since marine isotope stage 5.1 (~ 88 ka)" *by* X. Shi et al.

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Dear reviewer, Thank you for the constructive comments on this manuscript. You have raised some interesting questions, which we respond to below.

R#2: The manuscript entitled "Multiproxy reconstruction for Kuroshio responses to Northern Hemispheric oceanic climate and Asian Monsoon since marine isotope stage 5.1 (88 ka)" submitted by Shi et al. presents multi-proxies record of the region at northern part of the Okinawa Trough. In this manuscript, the authors state that the Kuroshio

is the main governing factor on regulating regional hydrography for the last 88 ka. The data is plentiful and is sufficient to demonstrate the main points. However, there are some questions need to be clarify in the manuscript. Nevertheless, the manuscript is now in acceptable format for publishing on the journal of "Climate of the Past".

R#2:1. According to the record, sand depositions are high in interglacials. However, during interglacials, the sea-level are in high-stand periods. That means sources of riverine and costal sediments are far away from the coring site. Why coarse sediments are enriched during high-stand but low in glacial interval when coastline is close to coring area?

MC: Based on the results of major and minor elements (Fig. 1-1), we found there are lots of coarse volcanic detritus in sediments of MIS 1, while during MIS 5.1, there is no volcanic detritus. So we can observe the difference between MIS 1 and MIS 5.1. However, during these two periods, the sand contents obviously are higher than other periods. We attribute it to the sorting caused by intensified Kuroshio during interglacials. Previous research noted that the provenance was closely related to the Kuroshio marked by increasing coarse fractions since 7 ka during high-stand in the middle Okinawa Trough (Dou et al., 2010). It is reasonable to speculate the same mechanism for the increased sand contents because the Kuroshio flows through northern Okinawa Trough during MIS 5.1.

R#2: 2. In the manuscript, the reconstructed SSS are important indicator for monitoring past changes of hydrography of the OT. The calculated d18Ow is based on foraminiferal d18O and alkenone-derived SST. This kind of calculation might be biased by the different growing seasons and dwelling depths of forams and coccolithophores. As mentioned in the manuscript, alkenone-derived SST is representative to annual temperature. But planktonic foram is possibly indicate to summer conditions, denotes in page 1350, line 2-3. Is there evidence to prove that alkenoen-SSTs are usable in calculating d18Ow of this region?

MC: For SSS estimate, it is better to use Mg/Ca derived SST because Mg/Ca is measured on the same organism and mineral phase that carries the δ18O information. They are linked to the similar physical properties of surface ocean. In addition, alkenone derived temperature also has been successfully applied to SSS estimation, as detailed in Rostek et al. (1993) and Yu et al. (2009). However, such SSS estimation, as the reviewer pointed out, might be biased by the different growing seasons and dwelling depths of planktonic foraminifera and coccolithophores. In this study, the surface dwelling species G. ruber was used to determine the δ18O, which mainly lives in the upper mixed layer of the ocean (0-50 m) (Hemleben et al., 1989), therefore the data obtained from G. ruber are thought to largely reflect surface ocean conditions. On the other hand, both seasonal fluxes of G. ruber and coccolithophores in the middle depth from sediment trap located in the Okinawa Trough are high in spring and autumn (Tanaka, 2003; Yamasaki and Oda, 2003), when most surface water properties, including SST and SSS, approach annual average SST and SSS. Therefore, Uk37-derived SST could be a good candidate to be used to obtain accurate average SSSs in the region. What's more, reconstructed average SSS for core CSH1 during MIS 1 matches very well with the instrumentally measured annual average SSS at the core site.

R#2: 3. The age model of this study is mainly built up with 14C-datings and MIS events. However, when check in detail of planktonic foraminiferal oxygen isotope record, the picked MIS 5.1 is not so clear. The authors notice that there is a discrepancy of the age of ASO-4 event, and attribute to the uncertainty. I suggest to that volcanic events can be useful independently age control points to replace the MIS 5.1. The whole story may not change a lot, but the age can be more reliable.

MC: Thanks for your suggestions. According to the previous report (Machida, 1999), the Aso-4 event mainly occurred in MIS 5.1, but there was no accurate age point, just a range. According to our age model (AMS 14C & δ18O), the third ash layer can be correlated to Aso-4. Because of the uncertainty of age point of Aso-4, it is risky to use Aso-4 as the age control point for core CSH1. Anyway, as the reviewer stated that, the

change of last age control point does not affect the whole story.

R#2: 4. In this study, the authors compare their records to other records of ODP1144 and MD972142. realize that the authors try to compare their records to others for better addressing the AM topic. However, there are other published records that have similar age intervals based on cores retrieving from the ECS and SCS regions, why select ODP 1144 and MD972142? Is there any reason? In the manuscript, I didn't read any information for speculating this choice.

MC: We want to get some information about Asian Monsoon from such comparison, which is closely related to the regional hydrography. Insofar as it can be ascertained, the changes of hydrographic conditions in the South China Sea is highly investigated and both records show good results. That is why we choose ODP 1144 and MD972142 to do such comparison.

R#2: 5. In discussion, the authors attribute the foraminiferal d13C record to land vegetation changes. But, mostly the foraminifer d13C data reflect the DIC of sea water, which may imply to surface production change and upwelled subsurface water influence. Why varied land vegetation? Is there evidence can help to speculate the point?

MC: As mentioned by the referee, the δ13C value mostly reflect the DIC of sea water, and the planktonic foraminiferal δ13C can be affected by changes in sea surface productivity, upwelling subsurface water, inputs of river runoff, et al. The mean δ13C values in global oceans decreased by 0.32‰ under glacial conditions (Duplessy et al., 1988). In this paper, he mentioned that Shackleton (1977) attributed such changes to the decreased forest cover during glacial periods.

R#2: 6. It's better to give detail information about the transfer function of DOT, such as modern analog database used in this study and estimated errors. It will be helpful to readers to judge the confidence of calculated DOT. Otherwise, what DOT means in this study? Generally, thermocline is a kind of depth range shows the mostly decreased trend of water temperature. So the value of calculated DOT in this study means the lowest reach of thermocline or mean depth of thermocline?

MC: Thanks for your suggestions. The DOT in the manuscript was calculated by using the thermocline depth transfer function of Andreasen and Ravelo (1997), which is based on the spatial distribution of 189 core top planktonic foraminifera in the tropical Pacific. The transfer function has a standard error of 22 m and additional 5 m of error due to insufficient counts in the core top database. In this paper, Andreasen and Ravelo (1997) noted that the mean annual thermocline (18âĎČ isotherm) depth was defined in the transfer function (P3, right panel, the third line to the last) (Andreasen and Ravelo, 1997). So, in our manuscript, it indicates the mean DOT. Moreover, such method has been successfully used to estimate the DOT both in the South China Sea and the Okinawa Trough (Jian et al., 2000a; Jian et al., 2000b; Li and Jian, 2001; Wang et al., 2001).

R#2: 7. The results of factor analysis of foram census data show that G. bulloides, usually represent to upwelling and the high nutrient inputs, is the most important and speculative species. However, the factor score of factor 1 displays a generally smooth pattern except the MIS 3 event and varied between -1 and 1, lesser than factors. I will expect a more fluctuated pattern of Factor 1. How come of this pattern? Is there any special reason for speculating this kind of variation?

MC: G. bulloides is an indicator of upwelling. It is very interesting that the high abundance of G. bulloides mainly occurred in period of MIS 3 in core CSH1. During MIS 3, the sea level was 80 m lower than the present, and the winter AM intensifed. It is speculated that the hydrographic conditions were helpful for the upwelling. However, until now we don't have more evidence to support this speculation. Further study needs to be conducted on this important issue in the future.

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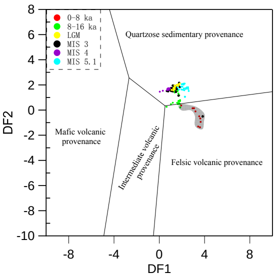

Fig.1-1 Geochemical discrimination plot to obtain possible provenances of sediments in core CSH1.

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