

Interactive comment on “Circulation and oxygenation of the glacial South China Sea” by Shuh-Ji Kao et al.

Anonymous Referee #1

Received and published: 26 April 2016

Kao et al. show a numerical simulation of the South China Sea (SCS) under both present-day and glacial sea level as well as with double wind speed. They also present a Mn/Al record from core MD972142 in the SCS. The goal of the study is to figure out whether biogeochemical changes observed at MD972142 can be explained by changes in oxygenation or changes in productivity. As the numerical study suggests that under lower sea level but stronger wind the residence time of the water in the SCS does not change much, they conclude that it is not changes in oxygenation that drove changes in biogeochemical proxies but changes in export production. The study is generally interesting and is worth publishing in *Climate of the Past*, if the comments below are addressed.

1) While the modeling work is interesting some links might be missing. At the moment the modeling and proxy work almost read like 2 separate stories. - There is no biogeo-

C1

chemical module in the model, therefore residence time of waters in the SCS is taken as a proxy for oxygen, thus suggesting that the main O₂ supply is through flushing of the SCS. Maybe a map of O₂ in the SCS and of the western Pacific Ocean (water feeding the SCS) would be helpful to make that point.

- The residence time increases during low sea level from 19 to 23 years. However, if the climatological wind is doubled then the residence time under low sea level is close to present day with 18.4 years. Most of the conclusions of the paper thus rely on the hypothesis that the winds associated with both the summer and winter monsoons were twice stronger during glacial times in the SCS. Evidence for such changes should be discussed in the text. A previous study suggests that most PMIP models suggest weaker summer monsoon and about half of them suggest stronger winter monsoon.

Jiang and Lang, Last Glacial Maximum East Asian Monsoon: Results of PMIP Simulations, 2010, nDOI: <http://dx.doi.org/10.1175/2010JCLI3526.1>

In addition, since both winter and summer winds were strengthened, the impact of weaker summer winds during glacial time on the residence time should at least be discussed.

- It is mentioned in the abstract and in the text that the upwelling west of Luzon and east of Vietnam were enhanced. Changes in upwelling are not directly shown in the paper. A map of upwelling areas and strength for the 4 experiments could at least be shown. I guess the reason why the authors suggest the upwelling was stronger is because they assume the wind was stronger. Stronger wind leads to stronger upwelling, which leads to higher productivity. But this is entirely built on an hypothetical stronger wind. . . . So basically, the authors hypothesize that the wind was stronger during glacial times, thus leading to no significant changes in residence time. In addition, if the wind was stronger then the upwelling was stronger, which is a bit of a circular argument.

Minor comments/typos More explicit name of experiments could be useful.

P2, L.24: wrong reference to dashed line in figure 1.

C2

Typos and grammar: Some issues with English

P 11, L10: "westward flow"

P11, L.21-22: rephrase

p12, L.20; "based on..."

p13, L. 22: "Based on ..."

P16, L.1-2: rephrase

Figure 2: Maybe a different color bar should be used (non linear). The x axis is too crowded, less numbers should be displayed.

Interactive comment on Clim. Past Discuss., doi:10.5194/cp-2015-167, 2016.