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Comment

## ***Interactive comment on “Evaluation of the eastern equatorial Pacific SST seasonal cycle in CMIP5 models” by Z. Song et al.***

**Z. Song et al.**

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Received and published: 31 May 2014

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### **Response to Referee #1**

*(Note: referee comments in black and our reply in blue)*

### **General comments**

Comment: This manuscript reported an improvement for simulating the SST annual cycle in the eastern equatorial Pacific in CMIP5 CGCMs, while some CMIP3 CGCMs have a semi-annual cycle rather than an annual cycle, as observed. The finding is usefule and important for the climate research and modeling communities, although the

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present analysis/conclusions might be only fair. I would suggest the following revisions. This manuscript reported an improvement for simulating the SST annual cycle in the eastern equatorial Pacific in CMIP5 CGCMs, while some CMIP3 CGCMs have a semi-annual cycle rather than an annual cycle, as observed. The finding is useful and important for the climate research and modeling communities, although the present analysis/conclusions might be only fair. I would suggest the following revisions.

Reply: We would like to express our sincere thanks to the reviewer for the comments. The new manuscript has been modified according to the reviewer's suggestions. These comments and suggestions greatly helped us in improving the quality of this manuscript.

### Specific comments

1. When I carefully checked Fig. 3 of de Szoeke and Xie (2008), it seems that many CMIP3 CGCMs can also simulate the annual cycle in the EEP SST, although weaker in magnitude due to a boreal spring cold tongue bias. The authors may need to quantitatively show the "improvement" for simulating the EEP SST annual cycle in the CMIP5 CGCMs (relative to CMIP3), such as by adding a direct comparison among the observations, CMIP3 and CMIP5 CGCMs in Figs. 3a and 3b of the manuscript.

Reply: Thank you for the suggestion. It's hard to identify which model can simulate the annual cycle in the EEP SST from Fig. 3 of de Szoeke and Xie (2008). So, I downloaded the same model data with de Szoeke and Xie (2008) except the IROAM data which is from the regional coupled model, and plotted the EEP SST seasonal cycle. The Fig. 1 below in this comment clearly shows that 8 (CCCMA CGCM3.1, CSIRO MK3.0, IAP FGOALS 1.0g, INM CM3.0, IPSL CM4, NCAR CCSM3, NCAR PCM1 and UKMO HADCM3) out of 14 models have the semi-annual cycle rather than an annual cycle. So, only 6 of 14 models are able to simulate the annual cycle. From our results in this paper, there are 14 of 18 CMIP5 models that can simulate the annual cycle. So in part it's an improvement. And according to the suggestion, We added the

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description of CMIP3 results in the introduction.

Revision in paper:

Line 19 of P.1131: “and pointed that most of these model simulate two cold phases in the EEP SST rather than a single cold phases” was modified to “and pointed that 8 of these models simulate two cold phases in the EEP SST rather than a single cold phase”

2. The manuscript reported a warm bias of EP1 in boreal summer, leading to a reduction in the amplitude of EP1 SST annual cycle. This is a useful finding. However, I think that the contribution from the cool bias in boreal spring is equally important in Fig. 3, and cannot thus be ignored. Li and Xie (2012) have regarded the cool bias as an ocean origin. The authors may need to add some discussion about the effect of the cool bias.

Reply: Thanks for the valuable suggestion. We totally agreed with the reviewer. As the reviewer pointed out, the warm bias in boreal summer and cold bias in boreal spring are contributed to the weaker amplitude of EP1 SST annual cycle equally. So, in the revised version of this manuscript, we added some discussion in the analysis section. And we also added the paper of Li and Xie (2012) to the reference list.

Revision in paper:

Line 20 of P.1135: “The warm bias in EP1 causes a weaker annual cycle simulation in the models, in contrast to the observations” was modified to “Eventually, the cold bias in boreal spring and warm bias in boreal summer in EP1 cause the weaker annual cycle simulation in the models, in contrast to the observations. Li and Xie (2012) have regarded the cold bias in boreal spring being from ocean (Li and Xie, 2012)”.

3. Technical corrections:

1) In Line 18 of P. 1131, de Szoeki et al. (2008)——de Szoeki and Xie (2008)

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2) In Line 8 of P. 1134, MME: multi-model ensemble mean

Reply: Done, thanks.

**OSD**

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