

## ***Interactive comment on “The mid-Pliocene climate simulated by FGOALS-g2” by W. Zheng et al.***

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We would like to thank the referee for the constructive comments and suggestions. The responses to the major comments are listed below:

1) For the topography in the mid-Pliocene simulation, we did use the anomaly method as suggested by Haywood et al (2010). The topography anomalies (PRISM 3ma - modern) were added to the model's topography. And the initial atmospheric conditions (e.g. ps, ts, ...) were adjusted to the new topography. We will revise the table 1 and related statement in the manuscript to make it clear. It is true that the annual mean SAT showed a warming everywhere, though the pattern of changes was similar to the multi-model ensemble mean. This may be related with the larger Climate Sensitivity of FGOALS, e.g. the CS was estimated to be 4.59 °C from the abrupt 4xCO<sub>2</sub> simulation (Zheng and Yu, 2013). The CS for the mid-Pliocene simulation will be calculated and

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included in the revised version of this paper.

2) The biases in the Arctic basin for the sea water temperature and salinity are related with the lon-lat grid used in the ocean model LICOM2.0, the currents in the North Pole are not well represented. We do not have such simulations by correcting the biases at present, so it is hard to estimate their contributions to the larger warming in FGOALS than other PlioMIP models. The larger SAT warming can be associated with the larger Climate Sensitivity and the removal of ice-sheets. Previous study (Li et al 2013) has suggested an inaccurate description of the cryosphere in FGOALS that leads to the cold bias of global annual mean SAT in the historical simulation, for example, a higher snow cover fraction on the Tibetan Plateau leads to higher solar radiation reflectivity and less land energy absorption. Therefore, the changes in ice-sheet in the mid-Pliocene simulation would also favor the warming of SAT, as it is shown in Fig. 2a that the maximum of SAT warming were located in Greenland and Antarctica where the ice-sheets were removed.

3) The wrongly referred figures and citation will be corrected, and we will try our best to improve the English writing. We much appreciate the referee's suggestions of grammatical corrections.

Many thanks,

Weipeng Zheng

Reference: Zheng, W., and Yu, Y.: Paleoclimate simulations of the mid-Holocene and Last Glacial Maximum by FGOALS, *Adv. Atmos. Sci.*, 30, 684-698, doi:10.1007/s00376-012-2177-6, 2013.

Li, L., Lin, P., Yu, Y., Wang, B., Zhou, T., Liu, L., Liu, J., Xu, S., Huang, W., Xia, k., Pu, Y., Dong, L., Shen, S., Liu, Y., Hu, N., Liu, M., Sun, W., Shi, X., Zheng, W., Wu, B., Song, M., Liu, H., Zhang, X., Wu, G., Xue, W., Huang, X., Yang, G., Song, Z., and Qiao, F.: The Flexible Global Ocean-Atmosphere-Land System Model: Grid-point Version g2:

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FGOALS-g2, Adv. Atmos. Sci., 30, 543-560, doi:10.1007/s00376-012-2140-6, 2013.

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**GMDD**

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