Reply to Reviewer #1

Thank you very much for your help to make our study more meaningful. We believe the quality of the manuscript has improved significantly after considering your valuable suggestions. The following is our point-by-point reply to your comments. The revisions made in response to your comments can be followed in the modified version of the original manuscript uploaded as part of this revised submission.

Comments:

The authors have addressed my comments fairly well. I just have a few additional points for them to address before the manuscript can be accepted.

1) Figures 2 and 3: Include a 4th panel showing differences between the model at 25 km and observations.

   We thank you for your valuable suggestion. We have checked figure 2 and 3 in the manuscript and found the differences between the model at 25 km and observations were shown in figure 2b and 3b, which can meet your suggestion.

2) Figures 4, 5, 6, 7 and 8: Is there a reason why the South Indian Ocean basin was left out?

   Thanks for your valuable question. The simulated tropical cyclone (TC) activities in South Indian Ocean (SI) can also be given. As your suggestion, we have added the TC information in SI on Figures 4, 5, 6, 7, 8 and table 5, which will make the manuscript more complete.

3) Table 4: The numbers of TCs is underestimated in every TC basin in the low-resolution version of the model compared to the high-resolution version, as expected. However, the numbers are the same in the western Pacific. It's hard to believe that a 100 km resolution version of the model can produce nearly 25 TCs per year in the western Pacific. Can the authors explain this?

Thanks for your valuable comment. Our previous work suggests that the FGOALS-f3 model in 100km resolution condition can resolve more than 70% of TC counts globally (Li et al., 2019). The possible reason is that the model can reproduce tropical waves when developed a Resolving Convective Precipitation (RCP) scheme. This scheme involves calculating the microphysical processes in the cumulus scheme for both deep and shallow convection, which the description of sub-grid convection is weekend. A more reasonable background of tropical wave in our model will be good for TC formation, especially in the western pacific (WP). On the other hand, the dynamical core in models also affects the TC simulating performance. The atmospheric dynamical core used in FGOALS-f3 is the finite-volume cubed-sphere dynamical core, which is similar to the GFDL global atmosphere and land model AM4.0 (Zhao et al., 2018a). We can find that the GFDL model in 100km resolution version can also reproduce TC activities globally (Zhao et al., 2018b). These results indicate that the model can reproduce TC in middle resolution when the coordination between the dynamical core a physical process is handled well (Zhao et al., 2012). However, the tracker scheme is also sensitive to the simulating result (Roberts et al., 2020a, 2020b). Our next work will reduce these uncertainties when considering more tracker schemes (e.g., TempestExtremes, TRACK, and TSTORM).

Reference

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Hodges, Kevin, Alison Cobb, and Pier Luigi Vidale. "How well are tropical cyclones represented in reanalysis datasets?." Journal of Climate 30.14 (2017): 5243-5264.

Roberts, Malcolm John, et al. "Projected future changes in tropical cyclones using the CMIP6 HighResMIP multimodel ensemble." Geophysical research letters 47.14 (2020a): e2020GL088662.

Roberts, Malcolm John, et al. "Impact of model resolution on tropical cyclone simulation using the HighResMIP–PRIMAVERA multimodel ensemble." Journal of Climate 33.7 (2020b): 2557-2583.

Zhao, Ming, et al. "Simulations of global hurricane climatology, interannual variability, and response to global warming using a 50-km resolution GCM." Journal of Climate 22.24 (2009): 6653-6678

Zhao, Ming, et al. "The GFDL global atmosphere and land model AM4. 0/LM4. 0: 2. Model description, sensitivity studies, and tuning strategies." Journal of Advances in Modeling Earth Systems 10.3 (2018a): 735-769.

Zhao, Ming, et al. "The GFDL global atmosphere and land model AM4. 0/LM4. 0: 1. Simulation characteristics with prescribed SSTs." Journal of Advances in Modeling Earth Systems 10.3 (2018b): 691-734.

Zhao, Ming, Isaac M. Held, and Shian-Jiann Lin. "Some counterintuitive dependencies of tropical cyclone frequency on parameters in a GCM." Journal of the Atmospheric Sciences 69.7 (2012): 2272-2283.

Li, Jinxiao, et al. "Evaluation of FAMIL2 in simulating the climatology and seasonal-to-interannual variability of tropical cyclone characteristics." Journal of Advances in Modeling Earth Systems 11.4 (2019): 1117-1136.

4) Replace Balaguru et al. (BAMS, 2020) with Balaguru et al. (JAMES, 2020). The wrong publication was cited in this case.

Thanks for your correction. We have replaced Balaguru et al. (BAMS, 2020) with Balaguru et al. (JAMES, 2020).

Reference

Balaguru, K., Foltz, G. R., Leung, L., R., Kaplan, J., Xu, W., Reul, N., and Chapron, B. et al.: Pronounced impact of salinity on rapidly intensifying tropical cyclones, Bull. Am. Meteorol. Soc., 101.9, E1497-E1511, https://doi.org/10.1175/BAMS-D-19-0303.1, 2020.

Balaguru, K., Leung, L., R., Van Roekel, L., P., Golaz, J., C., Ullrich, P., A., Caldwell, P., M., Hagos, S., M., Harrop, B., E., and Mametjanov, A.: Characterizing tropical cyclones in the energy exascale earth system model Version 1, J. Adv. Model. Earth Sy., 12, e2019MS002024. https://doi.org/10.1029/2019MS002024.