Dear Author,

Thank you for your revised manuscript.

I have to say that I find it somewhat disturbing that you submitted a first manuscript with so many typos. This is, for me, not very respectful for the reviewers that then have to take the time to list them. Fortunately, the form has been improved thanks to the numerous corrections you included in the revised manuscript following the reviewers' remarks.

It also seems that you have answered most of the more fundamental reviewers' comment on the content. However, it is hard for me to make a firm judgement on this as you did not, in your reply attached with your revised manuscript, always follow the rule that is to provide a clear identification of your changes in the manuscript for each of the reviewers' remarks (see https://www.geoscientific-model-development.net/submission.html#articlefiles):

> •The **author's response** in case of revisions must be submitted as one separate *.pdf file (indicating page and line numbers), structured in a clear and easy-to-follow sequence: (1) comments from referees/public, (2) author's response, and (3) author's changes in the manuscript.

Indeed, you followed this rule for your answers to the minor comments but not for the (most important) general comments. Therefore, I would like you to review your reply egusphere-2024-2682-author_response-version2.pdf , **indicating precisely what you changed in the text** in relation with your answers :

- p.2 : « We now explicitly link to a separate repository that reconstructs every figure from the manuscript. This was included in the original submission but may not have been sufficiently highlighted. It is now directly referenced both in the manuscript and the README. »
- p.2 : « We have added further instructions on obtaining and installing CESM2.1.5 and the associated CONDA python environments to ensure users can set up the required environment, including explicit instructions on necessary modifications. »
- p.2 : « Added explicit instructions for users to install their own version of CESM2.1.5. »
- p.2 : « Clearly indicated where modifications should be made within the codebase to adapt it to different computing environments. »
- p.3 : « Include a more detailed comparison of improved and degraded fields of the prognostic variables (U,V,T,Q,PS) at multiple model levels. »
- p.3 : «Included an RMSE table in the supplemental to capture the model state biases for the reader. »
- p.3 : «Improved upon our insights into why certain fields show improvement while others do not. »
- p.3 : «Clarify that while tuning will play a role in further optimizing performance, some improvements can already be observed with equal weighting. »
- p.4 : «Generally, in the manuscript, we have de-emphasized the point that the model could contain lower biases and instead focus on the platform specifications and the system. »
- p.6 : The paragraph on the «Synchronization in the Tropics and for Non-Nudged Variables », especially as you wrote « Future work should explore whether increased nudging frequency or selective tuning of nudging coefficients could help address this issue »
- p.7 : The paragraph on the «Energy Budget and Additional Fields »
- p.7 : The paragraph on the « Modes of Variability in the Tropics »

I also have the additional following comments that I would like you to take into account :

- On p.3 of you reply, you wrote « Duane and Shen (2023) reveal that often improvements are manifest in representations of localized structures, rather than in reductions in RMS error. We have searched for evidence of this, but find no direct measure of improvement in our system. » : can you add something in your paper to clarify that you did not find any improvement in the representations of localized structures in your system ?
- On p.4 of your reply, you wrote « There are no computational or physical constraints, though the models have been tuned at NCAR to represent fields well in their creation, likely this is why the distributions are similar. » ; can you add something in your paper along those lines ?
- On p. 8 of your reply, there is an insert «... rather than decades. Though, decadal non-local corrections have been made in a simplified coupled ocean-atmosphere model (Brajard et al. 2021). » ; what is this about ? I don't find this is the manuscript.
- On p.7 of your updated manuscript, the comma should be replaced by a full stop in « … period 1979 through 2005, The supermodel …. »
- On p.14 of your updated manuscript, you refer to Fig. 4S. If you refer to it, it should be included in the paper (not only in the supplementary material).
- On p.2 of your manuscript, I think you should mention up front that no training has been used in your current supermodel. On p.4, you mention « We also use the above-described training methods to optimize the performance of the supermodel, the results of which will be described elsewhere. » ; please be more specific about the « elsewhere » !
- On p. 5 of your manuscript, please revise the part of the sentence starting with as well as in « … which are linearly interpolated to obtain specified independent values at each time-step, as well as the evolution of aerosol emissions and trace gas concentrations (including CO2). » ; the current sentence reads awkward to me
- Finally, I am surprised that you implement your PAUSE/RESUME capability instead of using a dedicated coupling software such as OASIS (https://oasis.cerfacs.fr/), MCT (https://web.cels.anl.gov/projects/climate/mct/) or YAC (https://dkrz-sw.gitlab-pages.dkrz.de/yac/index.html) . Can you add any justification on this ?

With best regards, looking for your reply,

Sophie