We thank the two anonymous reviewers for the valuable comments that contributed to a substantially improved version of the manuscript. The major changes resulting from the two reviewer reports obtained are:

- adding further model evaluation criteria (regarding interannual variability, spatial distribution, 850hPa wind) resulting in some changes in the selected model set

- focusing the results on the best performing models only, called TOP6 throughout the manuscript and adapting previous results accordingly

- focusing on area that additionally fulfills monsoon definition (JJA minus DJF rainfall exceeds 2 mm/day) and providing results only based on this area

- using observational data (GPCC) instead of reanalysis data (W5E5) for reference

- discussing underlying physical mechanisms for changes in mean circulation (by analysing wind 850 hPa)

- adding a significance measure to give insight into the robustness of the projections following IPCC standards

- adding a new subchapter regarding the wet bulb temperature projections

We are looking forward to further feedback from the reviewers.

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Reviewer #1

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Review of "Consistent increase of East Asian Summer Monsoon rainfall and its variability under climate change over China in 34 coupled climate models" by Anja Katzenberger and Anders Levermann

General Comments: In this paper, the authors examined the future changes in the mean precipitation over the EASM region as well as its variability under different emission scenarios. Their analysis suggests that both mean precipitation and its variability are increasing under all emission scenarios, with a stronger response under stronger emission scenarios. There were many studies using CMIP5/6 model simulations that looked at the precipitation changes over different monsoon regions of the globe. Also, they find that the "wet-gets-wetter" arguments holds true for EASM region. Overall, the types of analyses presented in this paper are useful for regional climate change assessments. I have some specific concerns that need to be addressed before accepting the article.

Specific comments:

1. My major concern in this paper is the way in which the models are grouped. I don't have any issues with the "Group A" models which have a mean precipitation withing +/- 2 std of the observations (reanalysis). However, the Group B consists of the models in both sides of the extremes. This means that when you take the ensemble

mean, you are averaging the outliers on two sides and as a result there may not be any use of grouping the models in this way. You may either focus on the Group A models or have three groups (one group each for outliers on each side).

In the revised manuscript, we added further selection criteria (STD, CRSME, WIND 850 hPa) resulting in an adapted group of selected models, called TOP6. We follow the reviewer's proposition to focus on the best performing models.

However, depending on the research question, it can also have advantages to generally use a larger ensemble member size including over- and underestimating models. Particularly because the overestimating models compensate for the underestimating models resulting in reasonable multi-model performance. See e.g. Sing & AchutaRao (2018): Quantifying uncertainty in twenty-first century climate change over India.

2. It would be interesting to see the seasonal mean circulation changes as well. This will give a better understanding of the changes in the underlying dynamics

We strongly agree with the Reviewer that adding mean circulation changes is improving the manuscript which is why we added the change of wind at 850hPa between 2081-2100 compared to the reference period as multi-model mean. We also discuss the most relevant changes and compare individual model projections.

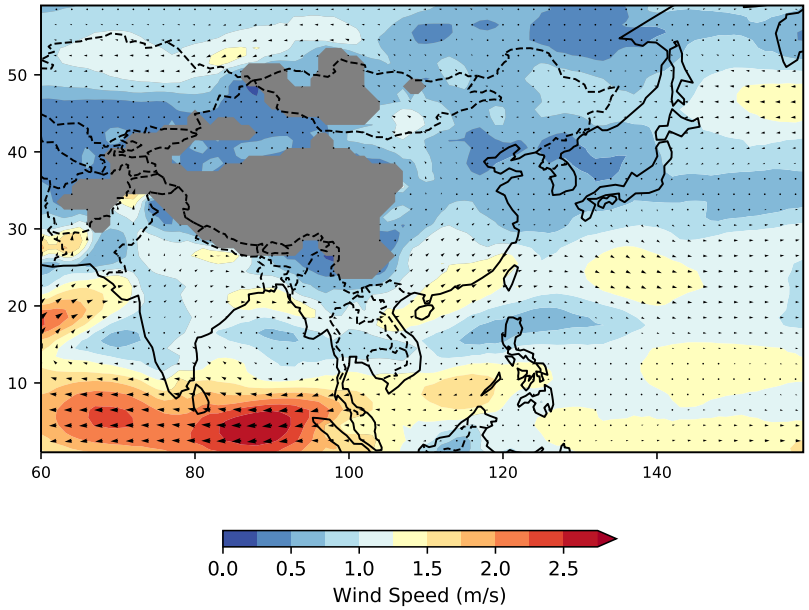

Figure 1. Change in wind vectors (850hPa) and wind speed (m/s) in 2081-2100 compared to the reference period in the MMM of the TOP6 models.

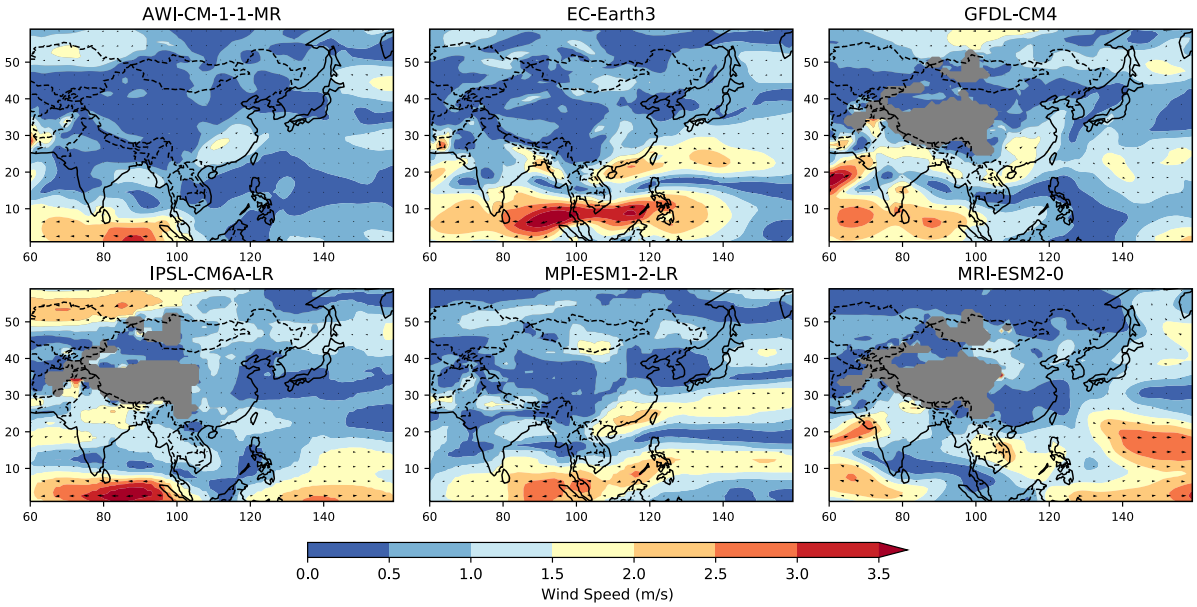

Figure 2. Change in wind vectors (850hPa) and wind speed (m/s) in 2081-2100 compared to the reference period for the TOP6 models.

3. The "wet-getter-wet" argument is not new. If you can look at the thermodynamic and dynamic components of the precipitation change, it can give a better insight.

We agree with the reviewer, that better insight is provided if adding an analysis of the thermodynamic and dynamic components. However, Xue et al. (2023) has provided these results in the meantime, which is we decided not to reproduce the same results within this manuscript. However, if the reviewer would like to see these results added, we are happy to add them to the revised manuscript.

Xue, D., Lu, J., Leung, L.R. et al. Robust projection of East Asian summer monsoon rainfall based on dynamical modes of variability. Nat Commun 14, 3856 (2023). https://doi.org/10.1038/s41467-023-39460-y