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# *Interactive comment on* "Significant spatial patterns from the GCM seasonal forecasts of global precipitation" *by* Tongtiegang Zhao et al.

**Anonymous Referee #2**

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This study examines the spatial patterns in skill of seasonal scale dynamical precipitation forecasts from the NMME models. By examining the spatial clusters of skill the study concludes that in general the skill pattern are spatially coherent – in other words regions with higher/positive [lower/negative] skills are typically surrounded by the pixels with higher/positive [lower/negative] skills. The study also finds the spatial pattern of the forecasts from the same climate center to be similar and that use of diverse models helps improve the regions with higher skill because of complementary skills.

This is a very useful study, as the authors argue that screening of forecast skill based on spatial pattern can help identify the regions with coherent high skill and hence the regions where the forecasts are likely to be most useful for decision-making. In addition to this implication, I think spatial pattern of regions with high skills can help with



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the attribution of skill. For example, presumably, the regions with known ENSO teleconnection would show spatial coherence in high skill.

I think this study is certainly suitable for publication however I would like to suggest some additional analysis in the hopes of further improving this manuscript.

(1) The figure 4 and 5 are great as they summarize several relevant information on the skill for the JJA season, I think it would be good to add similar figures for other seasons here in the main manuscript rather than in supplementary material. As of now the main manuscript has only 5 figures so the manuscript certainly has space for it.

(2) It would also be instructive to examine how figure 4 and 5 change with increase in the lead-time, as in general, for decision-making applications forecasts are most useful at higher lead times. It would be very interesting to see how spatially coherent high skill regions changes at higher lead times and how complementary the forecasts from different models are in increasing the overall multimodel skill. It would also be interesting to look into the attribution of the high skill spatially coherent regions. Of course there are several sources of skill but at the least, I would suggest the authors to contrast Figure 4 (for at least DJF and JJA seasons) with ENSO and precipitation teleconnection maps (maps showing correlation between the two).

(3) The results of this study, I think can be used to also highlight the minimum number of models required for majority of the skill, which could be very useful for numerically expensive operational applications when impacts models (such as hydrologic or crop yield models) are driven by dynamical forecasts.

(4) Lastly, I can't help but wonder how the results of HH regions over Africa would vary if a different precipitation dataset such as the Climate Hazards Center Infrared Precipitation with Stations (CHIRPS, https://chc.ucsb.edu/data/chirps) dataset used. CHIRPS ingests a lot more local in-situ observations than other precipitation datasets largely based on global in-situ databases (e.g. GHCN), and hence tends to be better than other global datasets (see: https://www.nature.com/articles/sdata201566)

Minor comments:

(1) Abstract: Please briefly explain global and local Moran's in the abstract as well. (2) Figure 2 is missing a color bar. (3) Figure 3: Please provide legends explaining the abbreviations HH, HL etc.

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