

Reviewer #1

I would like to appreciate how the authors reacted and responded to my previous comments. All of them have been addressed appropriately. I would just like to ask the authors to consider the following: (line numbering relates to the file egusphere-2024-1456-ATC1.pdf):

We thank the Reviewer and have made concerted efforts to address all of the below comments.

1. 205-210: Please mention that the results are shown in Fig. 3

We now mention that the moist static energy results are shown in Figure 2 (we presume that the Reviewer meant Figure 2 instead of Figure 3).

Section 3.4: Please mention that the comparison between raw GCMs (CMIP6) and downscaled CMIP5 outputs might be influenced by the choice of the subsets being compared and that the results regarding the dynamical downscaling might be slightly different in case different model subsets are analyzed. For instance, some of the CMIP6 GCMs belong to those with higher climate sensitivity in comparison to CMIP5 (e.g., Meehl et al., 2020). Nevertheless, the conclusions of the study, mainly regarding the inability of statistical downscaling to preserve the T-Prec. relationship, are not dampened.

We now state: “*Note that the comparison between the raw CMIP6 GCMs and downscaled CMIP5 outputs may be somewhat influenced by the specific subset of models, as some CMIP6 GCMs exhibit higher climate sensitivity in comparison to CMIP5 (e.g., Meehl et al., 2020).*”

Fig. 1: Could you comment on the fact that precipitation remains high after the onset of convection (panel d)? In this regard, it might be relevant to comment on the spatial variability in precipitation after the onset of convection (panel f). Is the spatial variability similar for all ten days after the peak day?

We now comment that precipitation remains high after the onset of convection: “*Precipitation anomalies increase rapidly in the immediate days following [convection], coincident with rapid surface temperature anomaly decreases, then remains elevated after the onset of convection.*” We provide below in Figure R2R1 the spatial variability in precipitation after the onset of convection. The spatial variability does not appear to be similar for all nine days after the peak day.

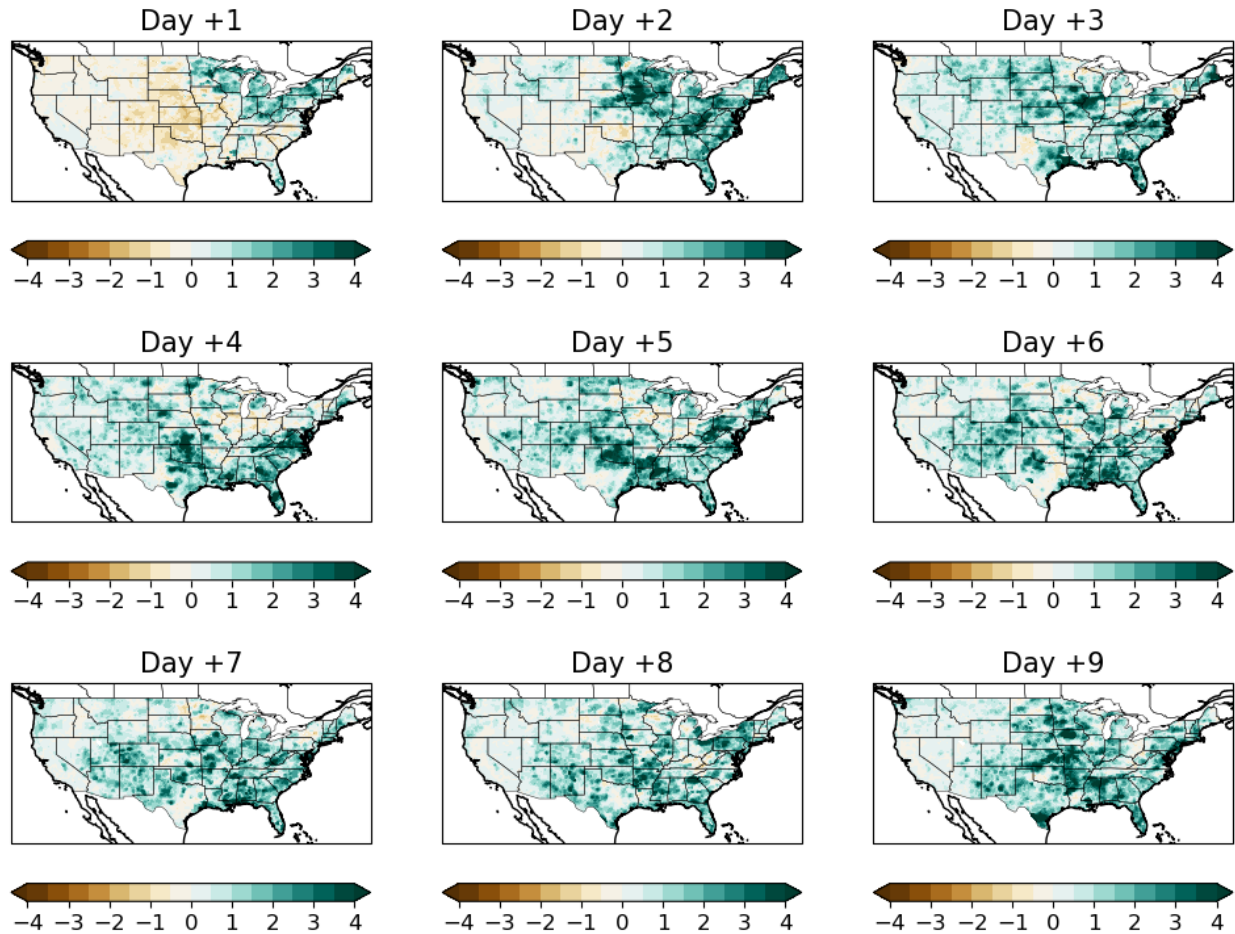


Figure R2R1: Spatial composite of precipitation anomalies (relative to the 21 day window analyzed) after convective precipitation.

Please check the units in the Figures. For example, in Fig. 11, the units for vertical axes are missing.

We have doubled checked units in all the figures. Fig. 11, for instance, has units provided in the title.

l. 300: "Over on" does not make sense; probably a typo.

We have addressed this error (we presume that the Reviewer meant Line 200).

1. 385 - 390: Please clarify what is the interpretation of MAE in connection to the P-T relationship.

We now clarify in the captions that “[m]oist static energy increases until the precipitation event and rapidly decreases immediately afterwards as the atmosphere stabilizes.”

Meehl, G. A., Senior, C. A., Eyring, V., Flato, G., Lamarque, J. F., Stouffer, R. J., ... & Schlund, M. (2020). Context for interpreting equilibrium climate sensitivity and transient climate response from the CMIP6 Earth system models. *Science Advances*, 6(26), eaba1981.

This is now cited.

Reviewer #2

Thank you for asking me to re-review paper: “Evaluating downscaled products with expected hydroclimatic co-variances” by Baek et al.

I remain convinced that this paper makes an important contribution. It makes two important tests for downscaling of: (1) how well does it perform against key high-resolution datasets, and (2) what, in particular, happens when both T and P vary, so with an emphasis on post-storm behaviours in both variables, differentiated by frontal or convective behaviours. The latter focus is novel and important for those interested in likely meteorological effects after major storms.

I can see that the authors have worked hard to respond to review comments (both mine and the other reviewer), and this is really appreciated.

The final request at this stage is to improve slightly the presentation of the diagrams. Below are a few suggestions for the authors to consider.

We thank the Reviewer and have made concerted efforts to improve the presentation of the diagrams.

Figures 1,2, maybe stretch out the colorbars to be wider, as there is space. Possibly make the fonts of the tick labels slightly bigger? For the panels a, d, g, these are single variables, so maybe use black for the curves, and the vertical marker, as a dashed line.

We have made the suggested changes to Figures 1 and 2.

Figure 3 – this clearly requires some sort of alternative colourbar, of spread of values, to prevent the entire plot taking the same colour.

We thank the Reviewer for the suggestion. After re-visiting the figure, the entire plot (for convective precipitation) appears to be taking the same color precisely because it is uniformly summer for the whole of the contiguous US (note for instance that there is much greater spread of values for the frontal precipitation plot). We have therefore opted to keep the original colorbar and spread of values.

Figure 4 needs a legend inside the plot for the two colours. “P anomalies before convection”, “P anomalies after convection” etc.

We have added the legend.

Figure 5 – According to Table 1, 8 ESMs are used. So there is likely room in one of the panels of Figure 5 to give a legend listing each of the ESMs. Or alternatively, you could place a legend stretched across the bottom of the multi-panel plot?

We now place a legend stretched across the bottom of the multi-panel plot of Figure 5. We have also added a similar legend to Figures 8, 11, and 12.

Figure 6 – I would help the reader in the caption by reminding that the LOCA2 data is a method to bias-correct different ESMs. So, then it is immediately clear that the different lines on (for instance) Figure 6a are the individual ESMs. Assuming this is the case, state “same colours as figure 5 for individual ESMs” (assuming a proper legend for the ESMs is given in Figure 5).

We now remind readers in the caption that LOCA2 is a “*method that bias-corrects and downscales climate models.*” We also now state that “[c]olored lines indicate same models as in Figure 5.”

In the left-hand column of Figure 6, it might help putting a plot title of either “Convective Precipitation” or “Frontal Precipitation” across the top of each individual panel.

We now indicate in the left-hand columns of Figures 6, 7, 9, and 10 that the top two panels are for convective precipitation and the bottom two panels are for frontal precipitation.

The authors themselves might find other ways to tidy up the diagrams.

We have made several adjustments, including those outlined above, to tidy up the diagrams.

Other than issues of presentation, I think the paper is nearly ready for publication.

We thank the Reviewer for comments that have improved the quality of our figures and the presentability of our paper.