

## Comment on hess-2022-103

Anonymous Referee #2

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Referee comment on "Characterizing basin-scale precipitation gradients in the Third Pole region using a high-resolution atmospheric simulation-based dataset" by Yaozhi Jiang et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-103-RC3>, 2022

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This study throws up an interesting topic on the precipitation gradients in the Third Pole. However, the presentation of the manuscript is rather rough. Some conclusions drawn from RPGs seem to be unreasonable. The manuscript needs to be further improved. My comments are shown as follows:

- The conclusions in Figure 2 are subjective. It is difficult to conclude that ERA5\_CNN is better than the other two products. In Figure 2(b) and (e), the conclusion that ERA5\_CNN is the most consistent with rain gauge data is clear. However, in the other sub-basins, the conclusion is not obvious. An indicator to describe the goodness of ERA5\_CNN may help.
- Are the sub-basins used in this study reasonable? It has been mentioned in the manuscript that the precipitation decreases with altitude above 2500 m. In a sub-basin, the altitude can change from below 2500m to above 2500m. As a result, the precipitation gradients in a sub-basin are not consistent. It may need more discussion on the basin-scale precipitation gradients.
- As the numbers of grid cells in different sub-basins are different, the same values of R in different sub-basins have a different mean. For instance, R with the value of 0.5 may mean a weak correlation in a 10-grid-cell sub-basin but a strong correlation in a 100-grid-cell sub-basin. Significance tests are necessary to show the strong correlations between precipitation and altitudes.
- In Section 4.3.1, more evidence is needed to support that strong seasonal variation exists in RPGs. The RPG is a value that the absolute precipitation gradient divided by the basin mean precipitation. The RPG will show a strong seasonal variation even if the absolute precipitation gradient has not changed. The strong seasonal variation in RPG exists but may not have any meaning.
- Why do the authors use the average RPGs of the five sub-regions to study the interannual variations? The interannual variations of RPGs in some sub-basins may be covered. It does not make sense to average RPGs of the sub-basins to represent the RPG of a sub-region.
- Where are the CV of annual RPGs for the sub-regions? The results should be shown in the manuscript. As RPG is a percentage, it is necessary to clarify the unit of CV. With the value of CV less than 0.12, it does not account for the conclusion that RPGs change little between different years. For example, the maximum and minimum values of RPGs

in Qaidam are  $\sim 9\%$  and  $\sim 13\%$  respectively. Considering the range of RPGs, the change is not little. Moreover, it can be seen that there is a periodic variation in RPGs in Figure 5.

- The trend tests are not found in the manuscript. How to draw a conclusion that there is no significant trend in RPGs in all the sub-regions?
- Because of the equation  $RPG = a/P$  and the positive correlation between P and RH, there is an inverse proportional relationship, rather than a linear relationship between RPG and RH. This analysis in Figure (a)-(e) does not make sense.