Response to the comments from Reviewer #4

We are grateful to the reviewer for the constructive and careful review. We have incorporated the comments to the extent possible. The reviewer's comments are italicized and our responses immediately follow.

The authors have enormously improved the manuscript. Thanks for the efforts. I think it can be published with a few more minor revisions.

Response: We would like to thank the reviewer for the positive comments. Please see our responses below.

1) Line124: "..aim to improving.." change to "..aim to improve.."?

Response: Revised as suggested (Line 122 in the tracked version of the revised manuscript)

2) Line150: Why use "long" as the abbreviation for "surface downward heat radiation"? You may consider deleting it as it does not appear in the following parts.

Response: Revised as suggested (Line 147).

3) Lines 156-158: "..which would generate distributed model parameters that are different within the catchment to better represent the heterogeneity of the rainfall-runoff processes". Please rewrite this sentence.

Response: Thanks for your comment. We have revised as follows:

"..The calibrated runoff parameters can better represent the heterogeneity of the rainfall-runoff processes and improve runoff simulations."(Line 155-157)

4) Line 249: Add "respectively"

Response: Revised as suggested. (Line 246)

5) Lines 283-290: "For the downstream areas with less precipitation, the higher NSE is related to the higher percentage of sand in the soil (not shown)." I doubt whether the higher NSE downstream can be explained by the spatial distribution of the sand proportion. In Figure R2, the downstream sand proportion shows a large spatial variability which is not consistent with the spatial pattern of NSE in Figure 3. It also confuses me that the higher sand content is related to better performance of the hydrological model, which seems to be contrary to the fact that the model performs better in wetter areas where the sand content is not very large. Please clarify.

Response: Thanks for the comments. The higher NSE in the downstream areas can be explained by two portions. In the Jiazhuan region (the southwest region of the basin), the performance is good because of more precipitation and not very large sand contents, which is consistent to the provided fact (Figures R1, R2). The south and southeast regions have similar precipitation as the northern region. With more sand portion, rainfall in such region will infiltrate easier, and yields less runoff under infiltration excess, which is more suitable for the saturation excess-based runoff scheme in the CSSPv2 model, and shows a better performance against the northern grids.
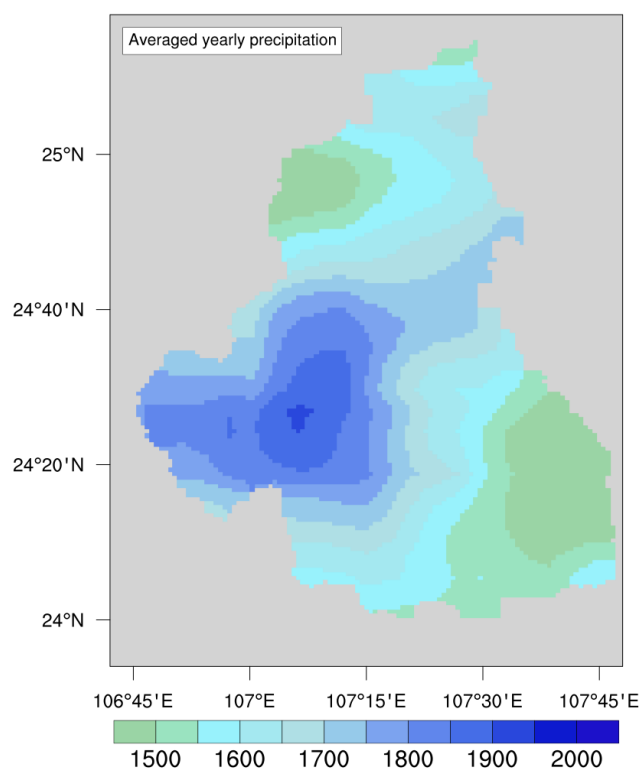
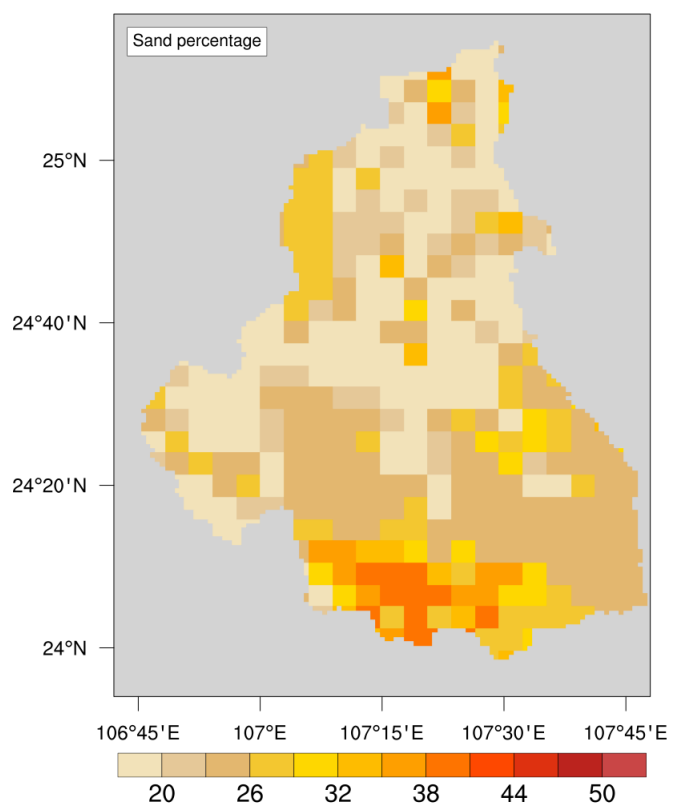**Figure R1**. The spatial distribution of average yearly precipitation (mm).

Figure R2. Spatial distribution of sand proportion.

6) Line 317: "..the ratio (for temperature).." change to "..the ratio (for precipitation)..?"

Response: Revised as suggested (Line 312).

7) Figure 8: The title is not consistent with that in the response to comment #8.

Response: Thanks for your comments. We have updated the revision (Line 632-634).