

Reviewer's report for gmd-2022-114-R1

The authors have largely addressed my comments in the original review, and their editorial modifications have clarified most of the paper's results. But meanwhile, the authors included some discussions absent in the original manuscript, which raises additional questions as below.

Comments

L140-142: "improvements are made to Sun scheme" It might be inappropriate to directly say the modified scheme is an improvement. -> "We propose two methods below based on the subgrid surface energy partitioning between sensible and latent heat fluxes"

L152: "input" -> "passed"

L155: "this process does not alter the sampled subgrid values just arranging them in a given sequence" -> "this process just rearranges the sequence of heat fluxes rather than altering their values"

L159: "One" -> "The"

L160: "another" -> "the"

L161: "the third ..." -> "the EXP_COR uses the modifications as described in Sect. 2.2"

L179-180: "one improvement we expected in the new scheme is the alleviation of the overestimated summer precipitation on the southern and eastern margins of the Tibetan Plateau" Why should we expect the precipitation bias will be reduced on the southern and eastern margins of TP? It is clueless for readers to get this point at this place. Rephrase this paragraph for clarity.

L185-186: "The simulated precipitation over Arabia and Indonesia is improved as well while that over the southeastern US is degraded." This sentence may be removed cause there are barely any differences between Fig. 3c and 3e, as well as Fig. 3b, 3d, and 3f, except that the improved precipitation in eastern China is visible in EXP.

L190: "the improved boreal summer precipitation over eastern China" It seems like the EXP_COR does not simulate better precipitation than EXP over eastern China as we see negative biases over there in Fig. 3f.

L195: Fig. 3 - It looks like the changes induced by EXP and EXP_COR are minor, particularly at a global scale. Does a figure of relative bias difference (e.g., $(\text{EXP}-\text{CTL})/(\text{CTL}-\text{TRMM})$) help if the authors want to highlight the improvement on the southern and eastern margins of TP? Also, the Figs. 7-12 in this manuscript have similar issues as in Fig. 3. See the comments as follows.

L206-208: The values of RMSE and the correlation coefficient in the context differ from Fig. 4.

L213-214: "both large-scale precipitation and convective precipitation slightly increase on the southern border of the TP" If so, an increase in the total precipitation should be seen in the southern margin of TP from Fig. 3c. It's apparently not the case here.

L214-215: "large-scale precipitation increases" It appears that the large-scale precipitation increases in the southeastern but decreases in the northeastern. In fact, the EXP run mostly improves the simulated precipitation over eastern China and has little impact on TP margins. Maybe removing the context regarding EXP TP margins is more acceptable than an inaccurate description.

L250-251: Why does the anticyclone over northern China decrease the precipitation on the eastern border of TP?

L264: Section 3.2 could be shortened to be more concise and organized. As it reads now, this section does not make much sense for improving the mechanistic understanding of climate response to the proposed surface heat flux parameterization. Most of the comparisons between CTL versus EXP/EXP_CORE or observations versus simulations are not distinctly shown in the corresponding plots, such that the analysis in this part is a bit vague and unconvincing. For example, in L275, the authors stated that the positive biases over southern China are reduced, but Fig. 7c and 7d are almost identical to each other and that improvement is not noticeable actually. In L339, "the underestimation over northern China and the TP in both the CTL and EXP runs is alleviated in EXP_COR", but Fig. 11d even shows darker green than Fig. 11c for northern China (i.e., EXP_COR has more negative bias than EXP in net surface shortwave flux).

L307: "larger" -> "large"

L319: "distributions of the CTL run" -> "distributions of the low, middle, and high clouds in the CTL run"

L371: "improves the simulations of summer precipitation in Asia" Does EXP or EXP_COR improve the precipitation in Asia? It seems like only for eastern China in EXP and TP area in EXP_COR.

L398-399: What values? Fig. S8 depicts the vertical structure of clouds.

L433-435: "Compared with MAM4 ... cloud macrophysics schemes in CAM6" Needs to be clarified. Are the authors comparing EXP_COR with physics parameterizations or comparing the physics parameterizations from different CESM versions?

Have a native speaker assist with the writing.