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Interactive comment on "Accelerated hydrological cycle over the Sanjiangyuan region induces more streamflow extremes at different global warming levels" *by* Peng Ji et al.

Anonymous Referee #2

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This is an interesting paper that analyzes the future changes in the streamflow extremes and its contributions from ecological factors over the Sanjiangyuan region based on observational data and model outputs driven by the CMIP6 data. Besides a regional accelerated hydrological cycle at different warming levels, the high risk of dry and wet extremes over the headwater of Yellow river and Yangtze river are also found. More importantly, the individual and combined impacts of land cover change and CO2 physiological forcing on projected hydrological changes are figured out and emphasized. Overall, the manuscript is well structured and presented, and there are a few minor comments below.

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Discussion paper

1. Line 156: I suggest references for CLM and CoLM are required here.

2. Lines 242-243: How to understand the phenomena that both the ET and runoff increase with the increase in precipitation, while the local water storage TWS changes little? Is it a common issue in the accelerated hydrological cycle in other regions? Maybe a further explanation for the little TWS change would be useful.

3. Line 251: Is "55%" statistically significant? I also suggest the significance tests for the rest of the changes at different warming levels in sections 3.2 and 3.3.

4. Line 270: In Figure 5a, the PDF of precipitation at 1.5 degrees warming level doesn't shift to the right against the reference period. Please correct the statement.

5. Lines 269-272 and Lines 281-282: "Over the Yellow river... the increasing trend of ET is stronger than that of precipitation". "Over the Yangtze river, however, intensified ET is much smaller than the increased precipitation". How to understand the opposite phenomenon over the two regions? The change in ET significantly influences the streamflow extremes changes over the Yellow and Yangtze rivers headwaters. Maybe a brief mention of that here would be useful.

6. Line 278: Change "Figure 3e" to "Figure 5e"?

7. Lines 274-280: "The above two factors together induce a heavier left tail in the PDFs of P-ET for the warming future than the reference period (Figure 5e). This indicates a higher probability of less water left for runoff generation at different warming levels, given little changes in TWS (section 3.1). Moreover, Figure 3e also shows little change to the right tails in the PDF of P-ET (P-ET>130mm) at different warming levels, suggesting little change to the probability of high residual water." It's hard to clearly distinguish the "heavier left tail" and "little change to the right tails" in Figure 5e and thus explain the large dry extremes and insignificant wet extremes. Can you give a more clear clue for that?

8. Line 320: How to get the value of "4-6%" for the acceleration of the hydrological

cycle under global warming of 1.5 degrees?

9. Lines 323-324: What's the period for the change of streamflow extremesïij§

10. Lines 327-329: I'm not sure what does the "nonlinear changes" mean. Can you add some detail for the nonlinear changes from future warming over Europe?

11. Lines 347-350: "Considering the LAI projections from different CMIP6 models are induced by the climate change, it can be inferred that the indirect influence of climate change (e.g., through land cover change) has the same and even larger importance. . .compared with the direct influence (e.g., through precipitation and evapotranspiration)." How to understand the direct and indirect influence of climate change on the streamflow extremes changes? Can you give a further explanation for that?

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