

Comment on hess-2021-646

Anonymous Referee #1

Referee comment on "Response of active catchment water storage capacity to a prolonged meteorological drought and asymptotic climate variation" by Jing Tian et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-646-RC1>, 2022

This study investigated the impacts of prolonged meteorological drought and asymptotic climate variation on catchment hydrology. The authors found that climate change has significant impacts on water storage capacity. Generally, I found this study is relatively novel, and fits well to the scope of HESS. And the results could benefit the community to further understand how terrestrial ecosystem responses to climate change, and their impacts on water resources. It has potential to be published in HESS. But I found some very important issues and biases, which need to be addressed before considering for acceptance.

- The catchment water storage capacity (CWSC) concept is not rigorous, and probably misleading. The CWSC is huge and unclear in most cases, which at least includes the water storage capacities of soil, groundwater, and surface water bodies, including rivers, lakes, and artificial reservoirs etc. In this study, the authors used the GR4J model, which has four parameters, θ_1 , θ_2 , θ_3 , θ . The authors said " θ_1 is the capacity of runoff producing reservoir in the catchment (mm)" and " θ_3 is the capacity of catchment reservoir (mm)". I am confused with these statements, and the physical connection between CWSC and the θ_1 and θ_3 parameters. To my understanding, the authors may want to say the active catchment water storage capacity, i.e. the root zone storage capacity, which determines rainfall-runoff process, by splitting rainfall into infiltration and runoff. For more research and discussion on this issue, the authors can refer these papers: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014GL061668>; <https://hess.copernicus.org/articles/20/1459/2016/>; <https://hess.copernicus.org/articles/20/3361/2016/>. In Line 509-513, the authors also mentioned that "the increased forest coverage of the catchment resulted in the larger water demand of the ecosystem, and thus a shorter response time of the CWSC to the meteorological drought." From this statement, I feel the authors also agree with me that the CWSC is a parameter related to ecosystem, rather than the total catchment water storage capacity. Also, they said "catchment has experienced a prolonged

meteorological drought, it would respond fast due to its large water demand". Obviously, ecosystems have water demand, rather than soil or groundwater. Hence, both thought experiment and overwhelming evidences manifest that the root zone storage capacity of ecosystems determined the separation of rainfall to runoff and infiltration, rather than the total CWSC. Moreover, from the perspective of ecosystem response to climate change, the paper becomes more interesting, not only for hydrologists but also for ecologists etc.

- The literature review is not comprehensive. There are already many important publications to understand both climate change and landuse change on time-variation of the root zone storage capacity. Please find more details here:
<https://hess.copernicus.org/articles/20/4775/2016/>;
<https://hess.copernicus.org/preprints/hess-2021-204/>.
- The English writing is readable, but still has room to be improved. The improvement on writing might not take much time for the authors, but can significantly improve the presentation quality and increase its impact.

Hope these comments can be helpful to improve the quality of this manuscript.