Comment on hess-2021-527

Anonymous Referee #1

Referee comment on "Spatial and temporal simulation of groundwater recharge and cross-validation with point measurements in volcanic aquifers with variable topography" by Alemu Yenehun et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-527-RC1, 2021

The paper reports regional study based on physically-based water balance WetSpass model, which has been applied to simulate the water balance components, including runoff, evapotranspiration and groundwater recharge, at Lake Tana basin in Ethiopia. Further, the spatial groundwater recharge map by WetSpass was validated through water table fluctuation and chloride mass balance methods. The topic is interesting. However, the paper under its current form suffers from several points concerning its content and structure. I'm not English native, but it looks that the paper needs bit English improvements to reach high written level required by high-tier international journal like HESS. The Introduction section looks too modest. Usually, the Introduction should provide a thorough literature review on the topic, starting from the general to the specific and clearly identifying the gap(s) in current knowledge that the paper addresses. This allows to formulate explicitly research questions, hypothesis, and the contribution of the study. The authors give general info on the recharge at the beginning followed by introducing the characteristics of the Ethiopian volcanic basin. However, it is not clear what is the issue. Novelty and justification seem the main issue of the paper. There is unclear scientific rationale on why the authors are pursuing the proposed study. The literature review seems does not specify clearly research gap(s) of previous studies. The authors stated that "Different methods are developed for recharge estimation. However, choosing appropriate methods is often challenging". This directs the reader to consider that novelty will be "developing recharge choosing tool", but it is not the case. Rather, the paper is oriented towards regional study focusing on groundwater recharge estimating and mapping. It is not clear what is the paper contribution compared to previous recharge studies conducted on the study area (e.g., Alemayehu and Kebede, 2011; Ayenew et al., 2008; Demlie et al., 2008, 2007b; Kebede et al., 2005). Other points when the authors mention that "the area has a climate with long dry winters and short rainy summer seasons. Hence, the groundwater recharge-discharge processes are expected to vary highly both spatially and temporally". I believe that with only two seasons and same type

of precipitation (rainfall) at the study area, there are other areas around the world presenting more complicate highly spatiotemporal variation such as the case of the humid northern regions dominated by variety of meteorological inputs or the subhumid regions submitted to many different seasons. My question, where is the situation of the present study compared to other recharge studies undertaken under different climatic conditions. Also, the authors indicated that "One of the challenges for the point recharge estimation methods is their incapability to estimate it in a spatially distributed way". I respectfully disagree with this statement as one of the main advantages stemming from integrating remote sensing with GIS within recharge mapping is in the capability to investigate the recharge at unprecedented levels of spatiotemporally variability. However, I agree that only limited studies have incorporated the spatial distribution of recharge with corresponding rates. Among them the references cited by the authors (e.g., Batelaan and De Smedt 2007). However, there is unclear scientific rationale on why the authors are pursuing the proposed study when they adopt the WetSpass model. The literature review seems does not specify clearly research gap(s) of previous studies related to the WetSpass model and the novelty compared to the previous WetSpass studies. If just using this model, the proposed study should be simple case study that can be fit with other journals like Hydrology Journal: Regional Studies. This seems confirmed with the main objectives cited at the end of the Introduction section. When the authors mention "studying the recharge mechanisms", what is the contribution relative to the existing work of Yenehun (2020) cited in lines 119-120 of the paper. For the methodology (Section 3), I raised some comments which are integrated in the attached document. My main concern is the structure of this section which seems confusing between methods and results. The authors introduce some results (e.g., developed maps) that should be placed in the Results section. Also, many methods are suffering from less details and explanations, and often the authors introduce some information without previous definition. This approach complicates the understanding of the methodology, while it looks appropriate to introduce a flowchart for the model development and explain how each equation, input or parameter has been adopted, calculated, or assumed. In many places of the text, the authors based on their own knowledge, but less detail is introduced. This cannot allow reader to judge this knowledge and understand the background of this knowledge. The authors provided criticism about interpolation in the Introduction section "it is unwise to extrapolate or regionalized the result by the conventional point recharge estimation techniques". However, many concepts (e.g., maps) of the proposed paper are based on the interpolation approach. In separate locations, the authors mention some ways that have been adopted for the calibration phase, it will be better to provide a sole section introducing all the calibration process rather to be distributed over several places in the text. I formulated many specific comments in the attached document, but I feel the paper suffers from a lack of novelty and structure. Regarding the raised comments, I believe the paper is not suitable for publication and I suggest directing it to other focusing journals.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2021-527/hess-2021-527-RC1-supplement.pdf