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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Estimation of water yield in the hydrographic basins of southern Ecuador" *by* Saula Minga-León et al.

Anonymous Referee #2

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This study examines the use of the Budyko framework based InVEST model to estimate water yield of the hydrographic basins located in the southern region of Ecuador. Based on hydro-climatic observations (precipitation, PET and runoff) and geo-physical attributes (soil/vegetation depth), the authors established the model by calibrating the single eco-hydrologic parameter (Z) of the InVEST model. Across the study area, the authors then identified basins with highest (and lowest) water production. While I welcome the author's contribution on predicting water yield in the complex terrain and data-scarce regions, at the same time I see number of issues with the current manuscript (mentioned below).

My main concern with this work is on the author's use of the Budyko framework for estimating water yield based on the functional form of one parameter Budyko model

(Fu's equation; ω) without any proper validation. A recent study by Padron et al., 2017 (https://doi.org/10.1002/ 2017WR021215) provides a comprehensive picture on control of ω – relationships of which to catchment geo-physical attributes are not very clear (i.e., they appears to be location/climate specific). Therefore before resorting to any sort of the functional relationship (for ω), it needs to be properly validated. The authors must show some sort of validations through e.g., split sampling test in time and space. Besides, it is not clear to me why the authors do not directly estimate the ω values through calibration. Such procedure is very common in literature (see the references given in Padron et al. 2017; https://doi.org/10.1002/2015GL066363; https://doi.org/10.1002/2015GL066363). I would like to see more discussion on this topic and especially the rational of author's selection (for the Budyko form).

Another major concern, I have with this study is the achieved overall modeling results. Considering even the functional relationship of ω (and Z to estimate) based on the outflows of 9 basins, results shown in Table 4 rather indicate very poor model fits in 4 basins; and other 2 have unreasonably low Z values (less than 5) and one at the border line of Z = 5. The authors then left with 2 basins in which the Z parameter can be reliably estimated; and based on this I do not see how you come up with the conclusion that "The modeling of water yield in the majority of hydrographic basins was satisfactory". Besides there is no information provided in the manuscript on how the Z parameters estimated in limited number of (sub-) basins are applied to the entire (hydrographic) region – or even at the pixel level (Figures 5 & 6)? How did you treat the bad preforming basins (in terms of it and unreasonable Z values)?

Page 7: It is not entirely true that "Data on the root restriction layer were unavailable" as authors, stated. Specifically in the HWSD database, which the authors are using – there is information on the root restrictions in so-called, attribute "ROOTS" (http://www.fao.org/docrep/018/aq361e/aq361e.pdf). Please double check. Also I think there is some mismatch between the authors plotted soil-depth (in Figure 3) and ones given in information of the HWSD database. In the manual of the HWSD, the

“REF_DEPTH” attribute is defined as: “Reference soil depth of all soil units are set at 100 cm, except for Rendzinas and Rankers of FAO-74 and Leptosols of FAO-90, where the reference soil depth is set at 30 cm, and for Lithosols of FAO-74 and Lithic Leptosols of FAO-90, where it is set at 10 cm. An approximation of actual soil depth can be derived through accounting for relevant depth limiting soil phases, obstacles to roots and occurrence of impermeable layers (the latter two refer to ESDB only)”. Besides it is not clear that how the authors use the information of the soil depth (from HWSD) and the Root depth (in Table 1) in estimating the Z parameter (or in AWC). Please clarify these points.

Table 3: Are the (irrigation) flow estimates being constant over the study period?

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