

Geosci. Model Dev. Discuss., referee comment RC3
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Comment on gmd-2021-137

Anonymous Referee #2

Referee comment on "DRYP 1.0: a parsimonious hydrological model of DRYland Partitioning of the water balance" by E. Andrés Quichimbo et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-137-RC3>, 2021

Authors have developed a distributed parsimonious hydrologic model to represent surface water-groundwater interactions and channel transmission losses in dryland environments. The modeling package is written in Python and provides some flexibility in terms of implementing a variable time step for different hydrologic processes and using different equations to represent infiltration. The new modeling package was set-up over the Walnut Gulch experimental watershed in Arizona and results were validated using observed streamflow, soil moisture and actual evapotranspiration data. Despite a relatively simple structure, the model was able to capture the main hydrologic processes of the studied catchment. The paper is well written and authors have performed robust model evaluation using synthetic and real numerical experiments. I provide a few comments below to further clarify some of the points discussed in the paper.

Line 75- Could you please explain which "hard-coded parameterization" you refer to here.

Line 145- How do you represent the streams? Is width of a stream equal to the width of a grid cell or do you have flexibility in representing the streams using different geometries? While this information is added later in the text, it would be more useful to state it earlier in the manuscript.

Line 335- Do you assume the subsurface is homogenous for both saturated and unsaturated zones?

In Equation 20- Do you assume a constant specific yield across the entire subsurface?

How do you define the riparian unsaturated zone? does the extent of the riparian zone variable or fixed?

Do you implement an iterative scheme to consider the two-way coupling between the saturated and unsaturated zones? Please clarify.

I suggest to move section 2.6 after section 2.1. to first describe the model inputs and then explain the equations.

What are the vegetation specific parameters in the model? It seems only the rooting depth is set depending on the landcover type.

Line 635- Since the model resolution is 300 m, it means the width of the stream cell is 300 m as well. This width is too large to represent the width of streams in arid regions.

Figure 9- Why do you show uncertainty bounds for the simulated soil moisture and AET and not the runoff? does the "red" simulated line represent the best model run in Figure 9?

Please discuss the limitations of the current model and future development plans.

Minor Comments:

Line 21- Add "distributed" to the model to provide this important information to the reader upfront.

Line 118 – Remove "(a la" from the reference

Line 120- Replace "streambed" with "stream stage".

Line 131 – Replace "an" with "a"

Line 275 – Add “runoff” to the next downstream cell

Line 355- Replace “relative water content” with “volumetric water content” .

Line 823 – Change “Fig. 9a” to “Fig. 9b”.

Line 832 – Change “Fig. 9b” to “Fig. 9c”.

Line 841- Change “Fig. 9c” to “Fig. 9f”.