

## ***Interactive comment on “Effects of antecedent soil moisture on runoff modeling in small semiarid watersheds of southeastern Arizona” by Y. Zhang et al.***

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This study examines the influence of initial soil moisture on runoff production in four semiarid watersheds of the Walnut Gulch Experimental Watershed using the Rangeland Hydrology and Erosion Model (RHEM). The Walnut Gulch is a well known experimental basin where a significant hydrologic database (rainfall, runoff, and soil moisture) is available. The main result of the study is the no significant correlations between measured runoff ratio and antecedent soil moisture (ASM). This seems a minor result, but, considering that the all the literature says the opposite, it may be an extremely relevant

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point. Nevertheless, it is my feeling that the authors did not stress enough this point and the structure of the paper should be more consistent with this major objective. As a general comment, I think that the paper requires major revision before being published that should incorporate all revisions of first reviewer plus those reported herein. The paper needs to be strengthened in its structure and results discussion, much more emphasis should be given to the runoff production mechanisms and modeling. One possible explanation for the obtained results (no correlation between ASM and runoff) may be due to the fact that the recorded events differ significantly in rainfall intensities and this may produce a result like this, but this or other hypotheses are not investigated or taken into consideration. In my opinion, author should try their best in order to provide a reasonable and physically consistent explanation for their results.

I have listed in the following a number of issues that should be addressed in this paper before publication:

- The first point refers to the main result of the paper that is also the title of the work. The effects of antecedent soil moisture on runoff production is investigated using modeled data, but authors have almost all they need as rough data measured in the field. What is the need to use a model in this case? Everything is already there.
- My second point is again a general comment on the used approach. The results of this work are uncertain for a number of reasons: the first of all is the modest variability observed in the ASM. The second refers to the uncertainty of the model that produces one result of the many feasible results possible using slightly different parameters. I understand that in this case only one parameter was calibrated, but several were assigned in using a deterministic approach while some uncertainty is always present.
- According all my reasoning above, my major doubt regards the ability of this approach to interpret correctly the surface runoff component (I assume that the term

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runoff in the paper refers to the surface runoff in order to be coherent with previous studies on this topic). Looking at the hydrographs it seems that a significant subsurface runoff component in the discharge is present. This has two implications one regarding the soil wetness of the basin that probably is wet enough to create such component and the second regards the modeled runoff that should keep separated the two components (surface and subsurface). A possibly strategy cope this issue is to separate low flow from surface runoff. One may use to this end the physically based filter proposed by Furey and Gupta (2001), but many are available in the literature.

- The authors used for their elaboration measured soil moisture at 5cm of depth. This measure may be significantly different from the dynamics of SM over the active soil column. Consequently, the soil moisture measured at 5cm of depth may not affect significantly the infiltration process. So, one suggestion is to test the relationship using the ASM integrated over different depths.
- The sensitivity analysis described in the paper is somewhat useless considering the limited range of variability of soil moisture adopted. Moreover considered the limited sensitivity of the model to the ASM it is almost obvious that mean or actual ASM does not make any difference in runoff simulation.
- Conclusions should be focused on the results of the research, while the discussion on previous works should be moved to the intro or in the discussion. Conclusions only focus on one of the results of the research and in particular on the fact that the runoff amounts and peaks simulated with long term average soil moisture were statistically equivalent to those simulated with measured antecedent soil moisture. Why?

## References

Furey P. R., V. K. Gupta, A physically based filter for separating base flow from stream-flow time series, *Water Resour. Res.*, 37 (11), 2709-2722, 2001.

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