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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Runoff generation processes during the wet-up phase in a semi-arid basin in Iran" *by* H. Zarei et al.

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General Comments:

This manuscript describes a brief study of rainfall-runoff responses in a watershed in Iran using both hydrometric and isotopic techniques. The authors make a clear case for the importance of the work due to the paucity of these types of measurements and analyses in the region and the importance of the results for understanding water supplies for large populations in the face of global change. In this respect, the work is well framed. In general, the manuscript is well organized and well written. The methods and analyses employed are common and described clearly.

The scientific significance of this work is limited. The work is primarily a case study and

demonstration of principles that are already understood about how watershed wetness conditions or antecedent moisture influence the hydrologic response to precipitation. In that respect, it does not reveal concepts or ideas. Observations from a data-sparse region like this one are certainly important and contribute to the scientific significance of the work, but unfortunately the analyses also suffer from data limitations stemming from the scope of the rainfall-runoff analysis. Specifically, the two precipitation gauges cover a very limited and relatively low range (720 m and 1080 m) of the overall elevation variability in the watershed (691 m to 3283 m).

Response: The limited scientific significance may on the one hand be true as this type of analysis has been presented numerous times in the temperate and boreal regions of North America and Europe. But as far as we know this has hardly ever been carried out in the semi-arid region of the Middle East where water availability is an increasing social, health and political problem. We do agree with the reviewer that observations from data-sparse regions is important and contributes to the scientific significance of this work. We acknowledge the lack of precipitation gauges, but will use the correlation in figure 1 to provide a better estimate on the topographic effect.

The authors do not discuss the potential effects of elevation-influenced precipitation gradients (other than to mention the presence of snow at higher elevations), and they neither account for nor otherwise justify lack of consideration for this possible effect when estimating runoff ratios. The authors should address this in a meaningful way and include a discussion of how this phenomenon could affect their interpretations.

Response: In the revised version of the text we will base the precipitation amounts on the elevation- precipitation gradients (Fig.1) and also better justify why some of the catchment can be excluded from the calculations as precipitation accumulates as snow at higher elevations.

Additionally, the authors show the spatial variability of rainfall isotopes, but do not consider how the corresponding uncertainty propagates through the mixing model to affect

estimated fractions of pre-event and event water discharged during the three storms. If one considers uncertainty, do the storms still provide different fractions of each?

Response: We agree this is a limitation of the previous version of the manuscript. We have done an error analysis that includes a study of the influence of the spatial variability in isotopic composition of precipitation that we will include in next version of the manuscript.

What, if anything, should be said about the different results for 18O and 2H? There is potential for more insightful analysis and interpretation of these three storms than what has been provided.

Response: Although, the two tracers produced slightly different results similar to previous studies (Kubota and Tsuboyama, 2003; Munyaneza et al., 2012; Hyde et al., 2013), the combinations of using tracers provide some additional confidence in the finding of high pre-event runoff contribution. The observed differences could be due to the consideration of spatial and temporal variability of deuterium and oxygen-18 concentrations in rainfall during the events.

Overall, this work has the potential to make a contribution to the hydrologic sciences, but at this stage the preceding issues limit its impact.

Response: Thank you! In the response to Reviewer 1 we have tried to frame the research question within a broader context long-term climate change context where declining precipitation is becoming an increasing problem. In additions we have made attempt to better accommodate the issues of uncertainties related to different tracers used. These questions will be improved in the revised version of the manuscript as well as better acknowledge the limitations and uncertainties in the presented results.

Detailed comments

The definition of runoff ratio on P3794 L19 is incorrect.

Response: Will be changed as suggested!

The phrase “topographic release” on P3795 L9 should read “topographic relief” instead.

Response: Will be changed as suggested!

Cited references

Hyde, E.A., Green, M., Boyer, J.N., Volitis, E., 2013. Using Specific Electrical Conductance to Compare Rainfall Runoff in NH Urban and Rural Catchments. American Geophysical Union, Fall Meeting 2013. Kubota, T., Tsuboyama, Y., 2003. Intra- and inter-storm oxygen-18 and deuterium variations of rain, throughfall, and stemflow, and two-component hydrograph separation in a small forested catchment in Japan. Journal of Forest Research 8, 179-190. Munyaneza, O., Wenninger, J., Uhlenbrook, S., 2012. Identification of runoff generation processes using hydrometric and tracer methods in a meso-scale catchment in Rwanda. Hydrol. Earth Syst. Sci. Discuss. 9, 671-705.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3787, 2014.

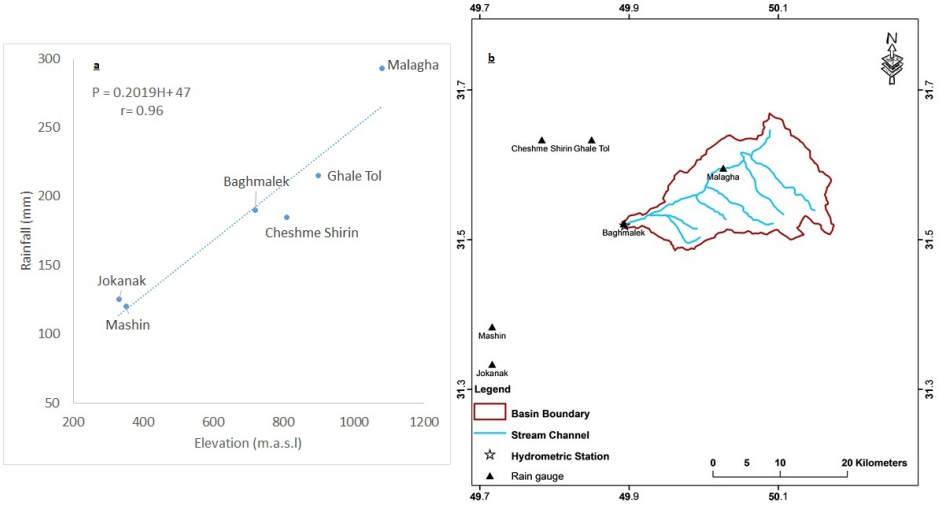

Fig. 1. a. Elevation- precipitation gradients during the study time November to February, 1b. Map including the study catchment and precipitation gauges.