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Interactive comment on "Multiple runoff processes and multiple thresholds control agricultural runoff generation" *by* S. Saffarpour et al.

Anonymous Referee #2

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General Comments: The content of the article is relevant to the hydrological community and meets the focus of the selected journal. It investigates functional relationships between antecedent wetness and rainfall characteristics and the streamflow response of a small agricultural catchment in Australia. In doing so the authors aim at identifying multiple co-existing runoff processes and potential threshold behavior between catchment-states and streamflow response. The dataset, comprising of hydrometric and hydrochemical parameters has potential but needs more quantitative analysis in order to address the outlined themes.

My main suggestions to improve the manuscript are the following:

I acknowledge the idea to use a decision scheme based on properties and mechanisms to structure runoff processes such as in Figure1. However, such a scheme is designed

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to result in one dominant runoff process and not in multiple ones such as outlined in the title. (We all know, that processes co-exist in different degrees of intensity). Original versions of such decision schemes are designed for the point or plot scale. While I acknowledge the authors idea to extend it with the concept of connectivity and timescales, I think that this causes a mismatch of scales. At least the authors need to define very clearly what spatial and temporal scale they are considering (and stick to their definition) and what the landscape units are, between which they consider connectivity. I suggest to come up with a separate Figure for connectivity

The method section needs to provide more quantitative information. (e.g. soil profile, total number of Q, GW, NS, monitoring sites, procedure of manual sampling, delineation of the saturated area, lab-analysis devices used. (Using two different devices for analyzing isotopes can cause considerable difficulties in comparing or pooling data). The result section is descriptive and lacks statistical/data analysis to quantify the authors' statements and derive generally applicable results. Some results are based on one or a few selected events only, which is not representative to draw conclusions. I suggest to exploit the entire dataset the authors have at hand and calculate statistics over all events. Some parts of the result section are the authors' interpretation and better fit in to the discussion section. Terms are either not defined in the text (e.g., in the method section) or not used consistently and the term "threshold" is used in circumstances where "exponential relation" is more appropriate.

The conclusions are drawn from one or two individual rainfall events and not logically derived from or supported by the results of this study. I would encourage the authors to refine and strengthen their analysis based on their dataset. I think it is good to discuss the findings in the light of Fig1. but as it is originally developed for point- or plot scale assessments it misses out the spatial (and temporal) heterogeneity across a catchment. – a fundamental aspect when analyzing thresholds and connectivity – and something that I think the authors try to address. For my detailed comments please see the provided pdf documents and summary of comments.

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In general, I think this manuscript has potential to be an interesting contribution to the hydrological society why I encourage the authors to work on a revised version.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-288/hess-2016-288-RC2-supplement.pdf

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