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Interactive comment on "Climate and hydrological variability: the catchment filtering role" *by* I. Andrés-Doménech et al.

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The authors address a deceptively simple, but important, question: "Does climate variability necessarily imply hydrologic variability?" They explore how changes in hydro-climatic forcing (rainfall patterns) are buffered by the landscape acting as a hydrologic filter, and then are reflected in catchment-scale hydrologic response (flood frequency). The exemplar setting used is that of small, hypothetical, ungauged catchments (LULC not mentioned) in the semi-arid Mediterranean region; global climate change effects are likely to be manifested in this region as greater variability in rainfall patters when compared to other regions. A more complicated scenario where climate change also brings about changes to the landscape filtering attributes (e.g., LULC changes; soil hydrologic properties; stream networks; etc.), thus possible climate-vegetation-soil feedbacks, are not examined. The authors derived an analytical expression for flood fre-

quency distribution [F(v)], based on the assumption that rainfall patterns can be described as a stochastic process; rainfall frequency modeled as a Poisson process, and event rainfall volume modeled as a Generalized Pareto distribution. They model, at the event-scale, rain-runoff transformation using the CN-SCS approach for events with rainfall volume larger than some threshold (initial abstraction). This approach then is useful for predicting "direct runoff", with the attendant limitations and simplifications of the SCS-CN model. I can appreciate why this popular model is chosen here, for simplicity and analytical formulation allowing the derivation of an analytical expression for the probability density function [F(v)] for direct runoff, given a stochastic rainfall forcing. This work is based on the assumption that each rainfall event, thus runoff event, can be treated as an independent event, with no "memory" of previous events. It is not clear how contingency is addressed in this work; because of non-stationarity, variations in initial conditions [e.g., antecedent soil-water conditions; storage deficit] can result in different catchment hydrologic responses (runoff generation) even for the same rainfall depth. Thus, the entire sequence of rainfall events (time series) needs to be considered, not only the rainfall events larger than some threshold. It is not also clear how heterogeneity in catchment properties (soil properties, vegetation, storage, etc.) can influence the threshold for runoff initiation and total runoff volume for events. Aren't the model parameters then some "effective" values for a hypothetical homogeneous catchment? How can their approach be extended to larger and heterogeneous catchments, the more common case? The authors do argue that examining runoff generation in pristine catchments is more important, but hydrologic dynamics of managed catchments might be more important and interesting, at least because they are likely to be more heterogeneous? The authors focus on peak flow distribution, which is of course one important hydrologic response variable. But, often, the pdf of the entire range of stream discharge is also considerable importance. Several papers by Gianluca Botter and Andrea Rinaldo, and others, present elegant analytical derivations for discharge pdf, under stochastic rainfall forcing (see recent paper by Botter et al., in PNAS; which also addresses the issue of hydrologic resilience of landscape under climate change scenarios). Using such approaches, the exceedance probability of certain discharge can be readily estimated. The authors' analysis shows that for rain events with low return periods (1-10 yrs), only the rainfall depth is the dominant factor determining peak runoff flows; only certain rainfall events larger than the threshold cutoff are important. This means that, a simple truncation of the Generalized Pareto distribution used for stochastic rainfall distribution will lead to the F(v)? For low return periods, the catchment filtration (abstraction; storage deficit) play an important role in "censoring" (filtering) the rainfall sequence in generating runoff events. These are also the conditions when the non-stationarity effects play an important role. Overall, the authors present a simple analytical approach to estimation of the probability of peak runoff flows in small catchments, which can many practical applications. The paper can be improved by inclusion of appropriate discussions of the limitations of the approach.

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