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Interactive comment on "On the value of high density rain gauge observations for small Alpine headwater catchment hydrology" *by* Anthony Michelon et al.

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This manuscript is the resubmission of the manuscript https://doi.org/10.5194/hess-2019-683 which has been entirely revised following the propositions of improvement of the reviewers. The modifications and additions can be summarized as follows:

- We introduce a confidence interval on the rating curve to account for errors on the salt gauging measures (Section 2). This error is reflected in the computations and related figures.
- The interpolation of the rainfall fields changed from the Thiessen method to a

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stochastic interpolation method (section 3.2.1). The standard deviation on the rainfall estimates is shown on the related figures and propagates through the computations involving rainfall measures.

- We use the rainfall maximum intensity over 10 minutes as a proxy of saturation-excess vs. capacity-excess infiltration (section 4.2.2).
- We tested the height above the nearest drainage (HAND) metric (Section 3.2.2) as an additional geomorphological distance measure.
- To account for the dynamic of the stream network expansion state (Section 4.2.3), the stream network varies between its maximum extent (wet conditions) and its minimum extent (dry conditions). The related geomorphological distance metrics (e.g. DHILLS DSTREAM, DHAND) are computed for both network extents. A composite network is also introduced, mixing both: the network extent is chosen (at the event scale) based on the initial catchment wetness conditions, based on antecedent precipitation.
- Most of the figures and tables in the main text and in the supplementary material have been updated to account for the above changes.
- The data and MatLab code associated has been updated on Zenodo to add the rainfall and streamflow uncertainty estimates https://doi.org/10.5281/zenodo.3946242.

Finally, we would like to point out here that during the first submission to HESS, the discussion arose whether a hydrological model could shed more light on how heterogeneous rainfall events impact the streamflow generation dynamics (link to answer to reviewer 2: https://hess.copernicus.org/preprints/hess-2019-683/hess-2019-683-AC2-supplement.pdf). While we considered the use of a simple model in a virtual experiment (with generated rainfall and streamflow values), we decided that adding such a modelling part would go beyond the key objective of this paper, which is a data-based analysis of the rainfall-streamflow dynamics of this catchment and the role of distributed rainfall observations. The analysis framework and results presented in the manuscript submitted here underline that for this (and possibly similarly small catchments), knowing the localization of rainfall is of key importance to understand the rainfall-runoff response. The results shed new light on the value of established geomorphological distance measures and their role for understanding the streamflow response. Furthermore, our work highlights the importance of observing the extension and retraction of the river network, which is rarely reported in similar studies.

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