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Interactive comment on "Climate change and uncertainty in high-resolution rainfall extremes" *by* B. Kianfar et al.

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General statement

The aim of our paper was to provide an example of the use of a stochastic simulation-downscaling approach for generating local (station-based) high-resolution time series of precipitation for climate change impact studies. The approach consists of a nested point process stochastic model for daily and coarser timescales and a multiplicative random cascade routine for disaggregation to subhourly timescales. In the paper we provide an application of how such a nested approach can be used for climate change impact assessment concerning extremes. More specifically we stress that stochastic uncertainty (internal climate variability) results in future climate scenario signals in rainfall extremes often being contained within the natural variability of present-day cli-

mate. The analyses are conducted for 22 meteorological stations in Switzerland with high resolution data, and are consistent between stations. The main message of our paper is that stochastic uncertainty should be included in climate change impact studies involving precipitation change, especially when extremes at a particular location (rainaguge) are the target. Models like the one we present may be used for this purpose. We acknowledge that there are other similar approaches in the literature, which we cite to the best of our knowledge, and we also acknowledge that our approach has some limitations, which in the revision of the paper we will highlight more prominently.

In revising the paper we will directly address all the individual comments of the referee and provide an itemized response letter. Here we provide an overview opinion only on what we believe were the key issues raised and how we will deal with them.

1. Factors of Change

The referee points out that Factors of Change (FoC) are used to perturb statistics instead of fitting the stochastic model directly to the climate model rainfall products because the latter have large biases. Indeed we did not think to stress this because it is obvious to us, but we will do so in the revised manuscript. We will also provide some citations to other approaches to avoid the bias in climate model simulation, for instance the weather generators which are conditioned on atmospheric predictors which the referee mentions.

2. Methodological details

The referee asks for more details in (a) validation of the nested model by goodness-of-fit measures; (b) parameter scale and intensity functions for MRC models; (c) how parameters are perturbed through FoCs. We do not think repeating formulas for parameter relations that are published elsewhere is particularly useful, but we will consider all of these improvements and make decisions based on added value and clarity they would provide in the revised manuscript. The referee also suggests that the presentation and discussion of the results is qualitative in part and would benefit from more quantitative measures. To this end we will report error measures for the key statistics in model performance. Also the statements about future climate predicted extremes lying inside the bounds for the current climate with 10-90% uncertainty bounds will be re-adressed by explicitly quantifying the statistical significance of the differences in the probability distributions of simulated extremes for the chosen return periods and temporal resolutions, not just differences in means. We will summarize the results for all 22 stations in the form of a new Fig 7.

For other comments of the referee which coincide with those of other referees please refer to the more detailed response to Referee 1.

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