

## Response to Referees

We thank you for your time and valuable feedback. Please see below, our responses (in blue color text) to the comments.

### 5 Referee 1

10 The manuscript “Modeling Spatial Fields of Extreme Precipitation – A Hierarchical Bayesian Approach” by Rahill-Marier et al. introduces a hierarchical Bayesian model for modeling spatial rainfall for extreme events of a specified duration which can be considered in regional hydrologic models to perform a regional hydrologic risk analysis. The spatiotemporal dependence is modeled through multivariate normal with partial pooling for the marginal parameter ( $\mu$ ). The proposed model is used to model the spatial field of rainfall at all 9 stations in New York City. The proposed framework and its application to New York City are interesting and well presented. I have some (minor) comments and technical corrections, especially concerning the ability of the model to capture the spatial dependence structure.

- 15 1. I would like to see further analysis about why the empirical quantiles for Staten Island (SI) are consistently underestimated. For example, authors could analyze whether the correlation between SI and other stations is overestimated or not. That could explain the overestimation of the magnitude. In Figure 1, SI shows lighter colors pattern for different durations, which is the opposite of the Central Park pattern.

20 Thank you for bringing this up. Upon re-assessment, we think that the comparison we presented here is not one-to-one. Ideally, one has to develop the spatial fields corresponding to specific return period events from the observations also to compare them with the simulations. This, then, will be comparisons of observed extreme spatial fields pooled for specific return periods with the ones from simulated fields from the model and the comparison will be on the probability distribution (or the cumulative distribution) of the observed extreme fields vs. simulated extreme fields.

We plan to develop and present these comparisons for the revised manuscript.

- 25 2. I suspect that it is the first one but would be good if the authors mention which model (partial pooling or no-pooling model). was used to generate figures 3 and 4

Figures 3, 4 and the A1-A3 (the figures in the appendix) are based on the SF hierarchical (partial pooling) model. We will make this clear in the manuscript and in the figure captions.

3. L129: Event?

Yes. Thanks for pointing out. It will be corrected in the revised manuscript.

- 30 4. L155: The authors say, “Fifty-four models (one for each duration and each site)”, but they did not mention which specific duration we consider. Please, specify this.

We actually run 216 models (9 stations and 24 durations each). We will correct this in the revised manuscript.

5. L158-159:  $\mu$  and  $\Sigma$  are leftover.

We will add the prior assumptions for  $\omega_k$  and  $\sigma_k^2$  immediately after this sentence.

35 6. L165-166: Authors already mentioned it in L 160-161

We will delete the redundant sentence in line 165-166 regarding number of iterations per chain.

7. L193: overestimated?

You are correct. We will change this in the revised manuscript.

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