

Interactive comment on “Copula-based downscaling of spatial rainfall: a proof of concept” by M. J. van den Berg et al.

P. Pinson (Referee)

pp@imm.dtu.dk

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Recommendation: Accept after minor changes

Overall comments

In this manuscript, emphasis is placed on the problem of downscaling spatial rainfall data. The authors describe a copula-based approach to this problem, as a natural continuation of the previous methodological developments and application work carried by 3 out of the 4 authors (Vanderberghe, Verhoest and De Baets). They rightly refer to this

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very work as a proof of concept, since more technical developments and application results would be necessary in order to properly apply and fully validate this approach. In a general manner, the paper is well written and the approach to downscaling clearly elegant and interesting. My recommendation would be to accept this paper for publication, after a number of minor revisions to be carried out. The required changes are detailed below.

General changes

My most important concern is that when reading a manuscript titled “a proof of concept”, I expect to see a much more detailed discussion of the limitations of the approach presented, as well as of the next issues to look at. The authors mention some of these points throughout the paper. In my opinion however, the paper would be stronger if the (very short) conclusions section was turned into a discussion of the approach based on the expertise they develop through this study. A few points that would be worth discussing include (among others):

- *the scope for application of this approach.* Do the authors see this approach mainly suited for simulation purposes or for prediction? If the latter, the question of the temporal validity of the copula structure could be of concern, as mentioned and studied in section 5.4.4. Also, do the authors feel that general copula structures could be identified for different types of storms and for various climates?
- *the general robustness of the approach.* The authors already discuss the robustness of their approach over 2-3 lines in the conclusions section. I would suggest extending this part. A few points are raised throughout the paper would be worth further consideration, for instance regarding the lower performance for quantiles with higher nominal proportions (for which less data is available), or related to the intermittence model (even though the authors seem to explain in section 5.4.3

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that the intermittence model did not have much impact on the general performance of the approach). The sensitivity of the approach to the chosen/estimated scaling (r/H) may also be crucial. Finally, the quality of the fitting of marginal laws to coarse-scale and fine-scale data may also be crucial, since the quality of the empirical quality estimated would clearly depend on the quality of the fit of marginal laws to the data.

- *the procedure to be proposed for further validating the approach.* The authors mention in the conclusions that a longer dataset will be necessary for validating their proposal. More than using more data, it would also be beneficial to know what aspects they will further focus on over this validation exercise. Would that be based on in-sample evaluation, out-of-sample forecasting (in space and/or in time)

In parallel, I would suggest for the authors to be more specific with respect to the data employed for illustrating the application of their proposal approach. For instance periods for which data is available should be mentioned, number of rain events over this period, dates for the storms used as case-studies given, as well as the characteristics of these storms. This would strengthen the value of the application described.

Specific and detailed changes

- In the introduction (p.208, l.19), the location chosen for the references is quite strange. I would suggest moving them to the end of the sentence
- There is a problem with the year of the reference Rubner (1998/2002). It is indeed 1998 in the reference list, but 2002 when cited in the text of the manuscript
- There is a typographical mistake remaining in the title of section 5.4.2: “sub-pixel”
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- Please correct the first line of page 226

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