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Interactive comment on "Precipitation extremes in a EURO-CORDEX 0.11° ensemble at hourly resolution" *by* Peter Berg et al.

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We appreciate very much the comments and suggestions, as well as the time and energy spent in reviewing our manuscript. Below are answers to all items raised.

General comments: The representation of sub-daily precipitation extremes and their future changes are investigated using a subset of EURO-CORDEX 0.11 climate models. The article gathers an impressive number of datasets and hourly-output from models to assess the limits to the use of convection-parameterised models at sub-daily time-scales in summer, which had never been done before. The authors first provide an evaluation of depth-duration-frequency curves (return-levels) against pre-calculated

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Discussion paper

country-wide DDF curves. They conclude that convection-parameterised models at 0.11 are not able to represent hourly intense rainfall events: they mostly underestimate 10-year return level precipitation. Their ability is mostly RCM dependent. However, the models show skills in representing 12-hourly return values. The authors show that the 12h return value is increasing with temperature in future climate scenarios, but that the slope depends both on the RCM and the GCM. Although not reliable, hourly intensities increase generally at a larger rate than 12-hourly intensities. This study introduces an interesting methodology and comparison with observations which could be further used in the assessment of future convection-permitting ensembles of models. I find the article scientifically robust, written in a clear manner and worth of publication in NHESS. I mainly have minor comments, which I believe could improve the manuscript.

Specific comments: 1) P6L19-21: Is the 3h separation for values below 3h enough to assume "iid"? You write that this is higher than many studies, but it is lower than Ban et al (2018) (2days) or Chan et al. 2014 (1day). Does using 1 day for all durations significantly impact the results? L21-22 is not comprehensible. Please clarify.

There have indeed been many different choices made for the time separation between events, and our choice is justified mainly in comparison to the literature presented on Page 6 lines 21–22. However, a clarification is in place here: the separation stated as x-hours is on both ends of the event, so for 1h durations, a period of 7 hours (3h before, the actual event and 3h after) is used to exclude further events. For 6h duration, a period of 18 hours is excluded. This clarification will be included in the revised manuscript. Further, we are interested in evaluating the models to the gathered observational data, and our choice for event separation is therefore mimicking their choices, as presented in Section 2.2. We will include this explanation in Section 3.2 together with the clarification above.

We doubt that the results would be significantly altered by using a 24 hour separation. As explained above, we are close to or beyond such a separation for the 6h and 12h durations, so these durations would not be altered. The shorter du-

rations might be, but some samples we made on the actual separation between the selected events show that although several events are close to the separation limit (e.g. 3h), the small peak we see close to the limit is not peaking at the limit, but some steps away from it. This indicates that the events are not part of the same peak precipitation period, but rather two peaks, or separate events, in succession.

Page 6 lines 21–22 are stating that we are conservative in our choices with our fix time step 1h data and fix duration block rains, compared to studies using event durations defined by connected time periods above a set threshold. This will be clarified in the revised manuscript.

2) P4 L17: "The analysis is restricted to summer-half years (April–September) to focus on the main convective season in Europe (Berg et al., 2009)." Note that you are missing most of the season of deep convective events in the Mediterranean (Sept.-Dec.): it may be worth producing the French map or Europe-wide map for this season, or extending the season to October. e.g.: Enno, Sugier and Alber (2018) Lightning flash density in Europe on the basis of 10 years of ATDnet data; 25th international lightning detection conference 7th international lightning meteorological conference You could also note that seasonality changes, such as reported by Marelle et al. (2018) are not taken into account in your study.

That is a very good point. We do not have the resources to redo our analysis for this paper since the calculation are quite time consuming, but will mention this unfortunate cut-off for the Mediterranean climate in the revised manuscript. Thank you for the references which we will also include.

3) This is a semantic question, but I find the term ”cloud burst” in the introduction rather ill-defined, it seems to be defined by its impacts, and to correspond to convective rainfall above 100mm/h? 50mm/h? 12h duration rainfall is probably more like frontal rainfall in most european regions, is this a ”cloud burst”? I would use the term ”heavy

precipitation event" or extreme precipitation event, which is probably less dependent on the type of precipitation event/the impacts it has.

We agree, and will change accordingly in the revised manuscript.

4) P2L34-35: Ban et al. (2018) do not find a stronger scaling for intense events in convection-permitting models compared to convection-parameterised models, to the contrary it is weaker in summer, which is your season of interest.

Thanks for noticing this, we will revise this sentence.

5) Figures 2-7 and S1-4: you show continuous fields with a diverging colorbar, this can me a bit misleading, please use a sequential (multi-hue) colorscale. https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-13-00155.1 You could start the colorscale above 0 to use all the colour intervals in the figure.

We will take this into account when revising the figures to make them as intuitive as possible.

6) It'd be interesting to see the spatial variability of the precipitation enhancement thanks to the additon of a map of future changes (e.g. 10-year return value of 12h-duration) for RCP8.5. In Fig. 8, you are pooling the results in a single figure, on which it is difficult to see individual regions (you could reduce the y limits to 60

Thanks for the suggestions. We will adjust the vertical limits for increased readability in Fig. 8. And we will consider including a map of the percentage scaling per grid point for rcp8.5, 10-year return value and 12h duration as suggested.

7) P2L20-21: you could add that convection-permitting models better represent Mediterranean heavy precipitation events (which stand out in your Fig. 4-5) and in some regions still overestimate moderate to intense hourly precipitation (Berthou et al. 2018).

Thank you for the reference, which we will include as suggested.

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Technical corrections: P2L16: add ”in Sweden”. P8L9: parameters fits -> parameter fits P10L15: intra-RCM spread -> inter-RCM spread P12L9: the core of the events -> the peak of the events P6L24: de Haans -> de Haan P6L24: Picklands (1975) not referenced

Thank you. We will adjust accordingly.

Berthou, S., Kendon, E. J., Chan, S. C., Ban, N., Leutwyler, D., Schär, C., Fosser, G. (2018). Pan-European climate at convection-permitting scale: a model intercomparison study. Clim. Dyn. http://doi.org/10.1007/s00382-018-4114-6

Chan, S. C., Kendon, E. J., Fowler, H. J., Blenkinsop, S., Roberts, N. M. (2014). Projected increases in summer and winter UK sub-daily precipitation extremes from high-resolution regional climate models. Environmental Research Letters, 9(8), 84019.

Marelle, L., Myhre, G., Hodnebrog, Ø., Sillmann, J., Samset Bjørn, H. (n.d.). The changing seasonality of extreme daily precipitation. Geophysical Research Letters, 0(ja). http://doi.org/10.1029/2018GL079567

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