

Interactive comment on “Temporal and spatial scaling impacts on extreme precipitation” by B. Eggert et al.

Anonymous Referee #3

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The authors employed very high-resolution radar data (in both space (1km) and time (5min)) and synoptic cloud observations to classify precipitation as either “convective” or “stratiform”. They then aggregated the precipitation events over particular spatial and temporal scales in order to identify which types of events dominate at a given spatial and temporal resolution. They further extend the analysis to explore the aggregate behavior of the precipitation types for extreme events (defined here as 99%-ile) and to identify “optimal” pairs of resolutions where information is maximized. For example for the current state-of-the-art Euro-CORDEX simulations at ~ 11 km a temporal resolution of about 20-25min is suggested as an output time. The goal is to serve as a guide for investigators as they aim to achieve balanced statistical information on extreme precipitation.

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Some of the conclusions confirm what most would suspect: convective precipitation events dominate extremes in summer time and at high spatial and temporal resolutions. Where the paper makes its most important contribution is as a guide for modelers as they work to set up model simulations that are capable of capturing precipitation extremes in terms of both spatial and temporal resolution. The authors’ identification of “optimal” spatial and temporal resolutions, which can be calculated using the relationships given, is a key finding. Thus, if one knows the phenomena of interest and its relevant scales in space and time (e.g., high intensity short duration convective rainfall) then it is a relatively straightforward matter to estimate the temporal resolution needed in order to maximize the available information. This insight will be invaluable as researchers set up model simulations that maximize information, are tailored to problem at hand and minimize cost. This is critical as the community begins to rigorously develop modeling frameworks for climate services. Additionally the innovative application of the Perkins Skill Score can be of utility in determining what resolutions extremes can be estimated at given available data. This will be important for evaluating larger ensembles at coarser spatial and temporal resolution for extreme events and sets the envelope on expected information delivery from such ensembles.

That said, the presentation could be clearer and the contribution better emphasized, especially in the conclusions and the abstract. The manuscript makes important and significant contributions and these are somehow lost. The paper presents a relatively simple and straightforward story that should have broad appeal; wherever possible the authors should opt for straightforward, direct explanations of their methods, results and conclusions. The specific comments spend a great deal of space on the introduction and discussion sections, as these are the weakest, to my mind. The methods and results sections exhibit a high level of rigor and understanding and could maybe benefit from some clarifications but are more or less fine.

Specific comments:

1) Are these results generalizable? Some discussion on this is needed. The authors

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begin to talk about embedded convection and complex topography (important over narrow mountain ranges) but leave it hanging. A few sentences about whether the relationships shown here might/might not be expected elsewhere would be valuable. Will every region require its own investigation? For example will the optimal pairs for Norway match those of Germany? Vietnam? UK?

2) Abstract: the aim of the manuscript should appear in the first few sentences not at the end. Also it would be helpful to mention that current approaches, to say, regional modeling, do not account for spatial and temporal dependence in a rigorous way. Emphasize the results and their implications (see reviewer 1 comments on this).

3) P2159 L4-6: The sentence beginning "However, in many cases..." is vague and has phrases such as "...weather, respectively climate, models..." that do not make sense. The point this sentence is trying to make is important try to re-word and make it more precise.

4) P2160 L10-14: It seems as though the authors wish to make a transition here from the discussion around the importance of, and challenges related to, distinguishing scales to a discussion on the physical processes governing convective and stratiform precipitation. If this is the case they should just say so, instead of the current, somewhat clumsy transition paragraph.

5) P2161 L4: This is actually a crucial motivation for the study and yet it is buried in the introduction. This should appear early on as a motivator and maybe even to kick off the nice literature review.

6) P2161 L6-17: A whole paragraph on the pitfalls of statistical downscaling predictors but then it is not mentioned again. Is it relevant to the current study? If so, then describe why. If not, then place the discussion in the proper context or take it out.

7) Overall the introduction is a bit lacking. I suggest restructuring as follows: i) Start with the problem statement. Why is it important? Why should we care? ii) What have

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others done on this topic (literature review)? iii) What questions are still unanswered (cf. problem statement)? iv) Describe How is this study going to answer them. v) Structure of the paper

8) P2163 3rd paragraph: The procedure for time steps longer than the 3hourly cloud observations is not clear.

9) P2175 Sec3.2: A quick question on the PDF approach. Are the sample sizes for each space-time pair roughly equivalent?

10) Section 4: The discussions and conclusions section, like the introduction, is lacking. The first paragraph is fine but the second should make a stronger statement about how this study sets itself apart. I suggest shortening some of the text under the main headings of this section. There is too much repetition of results and not enough interpretation and contextualization. There could be a vibrant description here of the implications these results have for future modeling studies and/or observational studies. One way to do this is to start with a bullet list of the four major findings and their main points. Then answer the questions: What are the implications of these findings? What issues or shortcomings remain? What are some potential future research directions?

Technical comments: 1) P2161 L27: Change to, "Here we take the perspective of an observer capturing...". 2) P2163 L15: Delete "single" 3) P2164 L4: Change from "is counted" to "are counted" 4) P2170 L11: "Consider e.g. climate model simulation data". There is no need for e.g. here, change to "Consider data from a climate model simulation."

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 2157, 2015.

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