Atmos. Chem. Phys. Discuss., 15, C241–C244, 2015
www.atmos-chem-phys-discuss.net/15/C241/2015/

Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #1

Received and published: 16 February 2015

The authors use 1km horizontal resolution, 3 hr radar measurements obtained from a composite of 17 radar measurement facilities, combined with cloud observations to classify precipitation into "stratiform" and "convective" precipitation. They then aggregate each type over different temporal and spatial scales, to see which types of event contribute most toward each space/time scale. The outcome is meant to help decide "on data resolutions where statistical information in space and time is balanced". For example, for optimal pairs of resolutions, the authors found that, convective events require about 1.75 times higher horizontal resolution at a given temporal scale than stratiform events.

Overall I think the authors have conducted a very interesting analysis, with some important implications. My only technical concern relates to the use of the "pdf overlap"

metric which comes from Perkins et al (2007). Statisticians have been concerned with this problem for over six decades, with the Kullback-Leibler divergence commonly used to measure the difference between two probability distributions, and the two-sample Kolmorogov-Smirnov test being commonly used to test whether two pdfs differ. I wonder why the pdf overlap is used in place of these more traditional approaches, and whether it matters (for example, is there any potential for the pdf overlap to give misleading results, for example due to different sample sizes between pdfs etc)? Other than this, I have the impression that the analysis is extremely technically rigorous.

The other major comment is that the significance and importance of the findings are not communicated as clearly as they could be. In the specific comments below I've made some suggestions that might help make the manuscript a lot more appealing to a broader audience, and I would encourage the authors to consider these comments as well as to think of other to improve presentation of the findings.

Specific comments

Abstract [general]: Most of the abstract is focusing on method (what was done) and a bit more emphasis needs to be placed on results (what was found/discovered). The implications are also a bit vague – for example the sentence "The resulting curve is relevant when deciding on data resolutions where statistical information in space and time is balanced" is very vague and should be made more precise.

Abstract, line 2: "Risk" is commonly defined as "probability * consequences". I think here it is only the probability that is of concern?

Abstract, line 3: "qualitatively" – why not quantitatively?

Page 2158: Introduction. I am finding the introduction a bit underwhelming. There are a lot of great threads of ideas, and the authors have succeeded in capturing the relevant literature, but the ideas could be brought together much better and the relevance of ideas to the paper made more explicit. For example, how is the "alarming"

ACPD
15, C241–C244, 2015

finding that statistical downscaling procedures assume that the empirical relationships between large and small scales hold in the future relate to the research proposed here? This issue in general, and predictor selection in particular, do not seem to be themes explored subsequently in the paper. Similarly, while it is obvious that convective and stratiform rainfall would require different climate model resolution (page 2162, line 5), it's not clear whether the space-time resolutions identified in this paper would necessarily be equivalent to the "minimal climate model resolution". What is the issue with the simple power law dependence not holding generally, and is the "regime-distinction" related to the classification of convective/stratiform rainfall or is this a different issue?

Page 2159: Can you provide a more formal definition of an Areal Reduction Factor here?

Page 2162, paragraph 2: the need for the study could be made stronger; the importance of this question is not stresses enough. Please include more literature or other examples to explain why it is importance.

Page 2163: How many synoptic cloud observation stations were used?

Second paragraph, page 2165 on temporal aggregation: Just a suggestion, but could "the effect of temporal aggregation is to even out spatial variations due to large-scale flow" be illustrated using a conceptual diagram? Similar for the subsequent discussion of Taylor's hypothesis. Again, this would help expand the appeal of this paper.

Equation 2, page 2167: Is "x" a length scale? Can you confirm whether this is consistent with the standard definition of an ARF? [since an area is a lengthˆ2 scale].

Page 2168-2169: This section would have been much more compelling with some illustrative diagrams of the "frozen turbulence" vs self-affine concepts, and how the choice of interpretation would lead to differences in space-time aggregation. This is the same issue as made in reference to the Taylor's hypothesis on page 2165, and I think that a conceptual diagram would make the results much easier to interpret.

ACPD
15, C241–C244, 2015

Page 2178: “the optimum temporal resolution for state of the art regional climate simulations, performed at a 11 km horizontal resolution, would be approximately 20 to 25 minutes.” This to me is an extremely important practical outcome of the paper but is a bit buried here. This is the sort of thing that could be highlighted in the abstract? Similarly, the finding that different meteorological events are considered extreme depending on the threshold is an interesting finding.

Technical corrections

Page 2159, line 3-6: this sentence was unclear, please rewrite. Page 2164: what is the role of the apostrophe in l’ ? This is not defined or used elsewhere. Page 2176, line 20: “smoothening” should be “smoothing” Page 2162, line 4-6: should be rephrased as a question Page 2165, line 4-5: unclear, please rephrase Figure 7 caption: “larger or equal” should be “greater than or equal to” Figure 8 caption: “larger or equal” should be “greater than or equal to”

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