

Interactive comment on “Changing seasonality of moderate and extreme precipitation events in the Alps” by Stefan Brönnimann et al.

Anonymous Referee #2

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Brönnimann et al. present an impressive and sound study on expected changes in extreme precipitation in the Aare catchment. Their major results are an expected future increase in rx1day (but less increase than might be expected by thermodynamic constraints), a change in seasonality for moderate extremes and no change in seasonality for rarer extremes. In addition, the authors present an interesting discussion and interpretation of their results.

There are two points that let this study stick out from many other papers: Firstly, the authors analyzed a huge ensemble of very different (global and regional) climate models of different generations. This enables them to draw much more robust conclusions than most other studies, since any common feature of such a diverse set of simulations is only very unlikely due to particular model deficiencies and more likely due to physical

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changes in the system. Secondly, the authors analyse the raw model output along with the bias corrected one. Since their main results are deducible from both versions of the dataset, this again increases credibility. As a side effect, they deliver very interesting material for the ongoing discussion about the limits of applicability of bias correction in climate change studies.

Thus I clearly suggest this study for publication after some minor changes/additions as follows:

1) The study analyses precipitation and temperature averages over a fairly large area with diverse geographical features. They clearly explain why they do so and I'm fine with it. However, when looking at 1-day precipitation extremes, there are likely to be quite some differences between those at station scale (that the reader might intuitively think of, when reading this study) and those averaged over 17000 square kms. I'm quite sure that we are not talking about the local convective systems that move slowly and therefore often bring extreme precipitation amounts locally, while neighboring stations are not affected. What kind of meteorological situations are we talking about? Probably frontal systems that move over the entire region? Could you please discuss this, to give the study the right framing? E.g. a typical example of an area-wide rx1day event opposed to a typical station-scale rx1day event would be very instructive. This is not mandatory, but at least a few sentences on the differences between station scale and area-average should be added.

2) One of your major interpretations of the results is, that thermodynamic constraints are not the dominating constraints for moderate extremes, but for rarer extremes (10 year's rx1day) thermodynamic constraints dominate. This would mean: The hotter, the more rain, right? If this is the case, why has the annual cycle of rare extremes a notch during the hottest phase of the year? (Figure 3, bottom left panel). Isn't that a contradiction? Please comment on that.

3) Editorial:

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Line 66: “(2) changes in the seasonal cycle of temperature on Rx1day events”. Something is missing here. Maybe “the effect of” in the beginning?

Line 81: “In this study we focus on experiments with regional or global models.” regional AND global models?

Line 141: “(iv) Finally...” This sentence hard to comprehend. After looking at the results, it becomes clear what you mean, but please consider rephrasing this sentence for better comprehensibility.

Fig S2: In the figure caption, there is a “Top:” to much.

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