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Interactive comment on "Local impact analysis of climate change on precipitation extremes: are high-resolution climate models needed for realistic simulations?" *by* H. Tabari et al.

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This paper compares climate model simulations and observations at different spatial and temporal resolutions with respect to extreme rainfall statistics. The authors develop climate factors and compare these for different model resolutions. It specifically addresses the gap in knowledge as to which spatio-temporal scale dynamic downscaling should be performed.

The paper was reviewed by 2 reviewers, both experts in the topic covered by the paper. Based on their reviews, I recommend a major revision of the paper, addressing the questions and concerns expressed by the reviewers.

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Discussion paper

In particular, a more rigorous description of the methodology is required, justifying the choices made in climate modelling approach and metrics chosen for comparing results. The presentation of results is sometimes confusing; especially, it seems that results are compared across different resolutions without explicitly addressing how scale differences influence the results. Also, I would recommend to more explicitly address the role of convection when discussing the modelling results at high resolution: how does the effect of modelling at smaller scales in and of itself relate the impact of including convection, especially when looking at extremes? Overall, the paper would benefit from a more critical discussion of results in chapter 4 and 5. A few specific remarks: - P5, line 5: “good accuracy of the simulations”: there is however quite a wide range between point observation and 27.8 km grid values, esp for higher return periods – I would not say there is sufficient agreement to call this "good accuracy" - P5, line 6: “systematic underestimation: this is clearly due to the spatial scale – you should make explicit that you’re comparing values for 2 so different scales. - P5, line 9: “ nearly unbiased”: i.e. unbiased compared to what? Not compared to the station observations: there seems to be a huge difference, esp. for T>5 yrs? - P5, line 16: “difference between climate model outputs and observations may be partly attributed to the spatial scale difference”. Exactly, see earlier remark. I suggest you try to explicitly distinguish between differences attributable to spatial scale and to convection permitting model - P5, line 30: “most of the ALARO runs underestimate the station observations”. Again, this is likely to be due to the difference in spatial scale - P6, 4-5: “more accurate simulations of 4 convection-permitting models”. Is the "higher accuracy", i.e. higher estimated precipitation intensities, due to disaggregating spatial scale or explicitly due to inclusion of convection? This has not been demonstrated in the paper so far. - P7, line 34-35: “Fig. 6 shows change factors for daily and 3-hourly precipitation computed using the CCLMEC-EARTH model with 34 different spatial resolutions for winter and summer seasons. The change factors for all extreme events with T > 1 35 year are shown in this figure.” This is not entirely clear to me, better to try and draw a more explicit conclusion: do regional convection-permitting models perform better or Belgium

or not? For what spatial/temporal scales do they perform better? What explains their better performance (just scale or is convection explicitly found to make a difference). Compare IDF values more directly to show % deviations (log- graphs are not very clear to see differences)

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