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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Convection-permitting regional climate simulations for representing floods in small and medium sized catchments in the Eastern Alps" *by* Christian Reszler et al.

Anonymous Referee #1

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General comments

Reszler et al. investigate the impact of spatial resolution in regional climate simulations on the capability of a hydrological model to represent the statistical characteristics of flood events in small catchments in the Eastern Alps. For this, ERA-Interim driven climate simulations with CCLM and WRF in different spatial resolutions (50km, 12.5km and 3km) are used as input data for the hydrological model KAMPUS. In a first step, KAMPUS is forced by raw model data, in a second step, by bias corrected simulation results. The statistical characteristics of the simulated floods are analyzed and compared to the measured runoff at stream gauges of six different catchments.

The study is very interesting, within the scope of NHESS and may merit publication. However, based on the presented results, I do not completely agree to the authors concluding statement that convection-permitting simulations are essential for a good flood representation. For uncorrected raw model data, this is obviously the case (figure 7, 8). But the bias corrected 50km simulation achieves, from my point of view, at least as good results as the uncorrected 3km run (figure 10, 11, 13, 14). This raises the question, whether a computationally expensive downscaling to 3km is necessary for a statistical consideration of floods or if bias correction of coarse data is sufficient? Based on the presented results, I would suggest that the improvements (if existing) of a downscaling to 3km do not justify its additional costs. I would recommend to put this question as central statement of the paper and thus, a major revision is needed.

A second interesting point of this study is that floods are only well represented in CCLM and not in WRF (figure 13, 14). This highlights the relevance of an adjusted RCM for each research area and should be mentioned and discussed more prominently.

specific comments

page 1, line 16: I would not say "ensemble" in this context, since the simulations are not really used as an ensemble. "Model chain" would be more appropriate.

page 1, line 21: I would use the term "coupling time step" to avoid confusion with the model time step.

page 6, line 9-11: The example is difficult to understand and should be rewritten. In general, the method of the bias correction should be described in more detail.

page 7, line 1: Why does KAMPUS use a temperature threshold to calculate the snow accumulation out of precipitation, instead of using directly the simulated snow from the RCM? CCLM 4.8_clm17 is known to have a cold bias in Winter, especially in 50km simulation (Kotlarski et al. 2014). In this way, this snow calculation method may lead to an overestimated snow amount in the hydrological model, resulting in a high snow melt

in spring which may cause the high flood peaks in spring in the CCLM 50km simulation. By correcting the cold bias in the CCLM results, this overestimated snow accumulation may be reduced, potentially explaining the improved seasonality in the bias corrected 50km simulation.

page 8, figure 3: What are the red areas?

page 10, figure 4: Why are you showing the average January precipitation amounts during night to highlight the added value of increasing model resolution? This is not the time frame in which I would expect the highest benefit from high resolution simulations (especially convection-permitting), but rather for summer (afternoon) precipitation.

page10, figure 5: The figure shows that the added value of an increased resolution is mainly caused by an improved diurnal cycle of precipitation. I would recommend to mention this more prominent, since this is very important for a realistic description of floods in smaller catchments.

page 11, line 7: Please add a reference for NSE.

page 12, figure 6: calibration and validation results should be drawn in different colors. In this way, it's difficult to assess the quality of the validation results.

page 24, conclusions: see above the general comments

References

Kotlarski, S., and Coauthors, (2014). Regional climate modeling on European scales: a joint standard evaluation of the EURO-CORDEX RCM ensemble. Geosci. Model Dev., 7, 1297–1333, doi:10.5194/gmd-7-1297-2014

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