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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 #2

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The manuscript investigates the added value of increased RCM resolution and bias correction to simulate localized heavy precipitation events over the Eastern Alps. Two different RCMs are tested (WRF and CCLM), both forced by ERA-Interim, and considering three nested domains at different resolutions (50km, 12.5 km and 3 km). The simulated precipitation fields are used as input data for a hydrological model over different sized catchments. The authors also investigate the added value of employing a bias correction technique to the hydrological model input data, using a Scaled Distribution Mapping method. The simulated results are compared against observational data in the 1989-2010 period, using different statistical measures. The study is generally interesting and well written. Nevertheless, I have some several concerns that I would

like the authors to address

Pg. 13, lines 8-11: In Figure 7 the improvement in using CCLM at 0.03° is very clear for the smallest catchment. But for the catchment with 119 km2, 0.11° obtains the best agreement, and even 0.70° seems closer to observations than 0.03° (except for the longest return period). In other catchments, coarser resolutions are also closer to observations. Stating that "simulations with coarser RCM data already yield reasonable results" is somewhat insufficient. Because increasing the resolution (to convective permitting) seems to degrade the flood frequency simulation in some cases (e.g. Voistsberg/U. Kanaish except for the highest return period, or Fluttendorf/Gnasb. compared to 0.11° or even 0.70°; Tillmitsch/Lassnitz and Leibniz./Sulm at intermediate return periods). This requires a more careful discussion. The presented results imply the need for a priori knowledge of the best resolution for flood frequency simulation in each catchment .

The improvement is even less clear when using WRF, which is given in supplementary material. On this matter, the choice of presenting WRF results as supplementary material is not clear to me, and I have some concerns about it. It is stated in the abstract that the manuscript is discussing two RCMs (and no further distinction is made between them is made). This is again repeated in the last paragraph of the introduction. The fact that the added value of convective-permitting resolution in WRF is lower, and often non-existent for both flood frequency and seasonality seems like a main result, given the aim of the proposed investigation.

Inspection of Figures 13 and 14 also raises major questions about the value of convective permitting resolution and bias-correction. The best resolution and whether bias-correction improves the results seems to vary significantly between different catchments.

Then in the conclusions it is stated that: "Flood frequency and seasonality is represented well in all catchments (. . .) However, the 3km grid size is essential for catch-

ments smaller than 200 km2" This seems like an overstatement. For Fluttendorf (119km2), using CCLM uncorrected at 0.11° is better than 0.03° for simulation of flood frequency; and in the corrected case the essential nature of 3km is not clear at all. For WRF, 0.44° and 0.70° are better for uncorrected case considering flood frequency over Fluttendorf. For the corrected case, the essential nature of 3km for flood frequency is not evident. Seasonality in WRF is very often degraded by 0.03° resolution, for both corrected and uncorrected, including in the catchments with <200km2.

It is also stated in the conclusions that "in the larger catchments, the 12.5 km and 50 km resolution already yield satisfying results regards flood statistics". Concerning the flood frequency, the results are not "often not already satisfying", the problem here is that increasing to 0.03° degrades the results. Hence we need a priori knowledge of whether we should use convective permitting or not. For Seasonality, CCLM does seem to be improved by using 0.03°, but not WRF, which is also problematic. The abstract also reflects these unclear statements of added value, when compared to the results.

Minor Comments

- Pg. 1, Line 10: "an in increase in regional climate model". Instead of repeating "regional climate model", it could be replaced by RCM or just model.

- Pg. 1, Line 10: "Increase in regional climate model resolution and in particular, at the convection permitting scale, will lead to a better representation of the spatial and temporal characteristics of heavy precipitation at small and medium scales". This sentence is technically correct, but it's not very clear. It could be re-written. Increasing the resolution will lead to a better representation of small scales. But if we are using a coarser resolution the small scales are not represented (they are not explicitly simulated). Of course, this will depend on what is meant by "small and medium scales", which is not entirely clear. Perhaps quantify these. Notice that throughout the text "small and medium scales" is also used rather loosely. For example, in Pg. 3 line 13 it

is (30km2 to 1000 km2), but in pg. 8 line 17 it is (75kms to 200km2), while <1100 km2 is referred to as large.

- Pg. 24, line 10: "Moreover, catchments with an area less than 100 km2 require a 1-hour time step due to the short response times": this is based on one single case (Schwanberg)? Perhaps it should be stated that "Moreover, the catchement with an area. . .". It this generalizable?

- Figure 14 the green circle in the last panel (bottom right) is not visible.

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