

Review of Do convection-permitting regional climate models have added value for hydroclimatic simulations? A test case over small and medium-sized catchments in Germany (Round 2)

I would like to thank the authors for their careful reading of the different reviews and the amount of work they put into replying to comments and editing the document.

The hydrological section has been positively improved and clarifies reviewers' comments by better understanding the experiment and simulated processes. The significant biases of extreme precipitation in the ICON3km simulation have been clearly described. The explanation of the authors regarding these biases and their transfer on hydrological modeling is convincing with fair analyses and discussion. The manuscript quality has been greatly improved and can be addressed for publication after considering some modifications.

- 1) In their response, the authors emphasised the focus of the hydrological aspect of this study on summer convective events. This is stated line 185, but I think this should be clearly stated at the end of the introduction when describing the aim of the study.
- 2) line 191: We understand after the author's response and Fig 14 that 8hours is the value chosen for computing the antecedent rainfall. Why this value ? In Ross et al. (2021), the minimum antecedent rainfall value to compute their analysis is 1 day. Other studies from neighbouring countries have chosen values from 1 to several days (Froidevaux et al., 2015; Staudinger et al., 2025). 8h seems to be too short a window to capture rainfall phenomena preceding the rainfall-runoff event, given the geographical context of the basins. Could you adapt the analysis of the non-linearity of the rainfall-runoff relationship with a value of 1 to several days and see if this changes the results?

3) Section 3.1.5 - Precipitation. I thank the author for better highlighting the strong overestimation of ICON3km precipitation in this section from line 295 compared to the first version of the manuscript. However, I sincerely believe the choice of the percentile for hourly precipitation could better highlight the strong biases on the precipitation extremes through the medians of values exceeding this percentile.

In your analysis, the point of studying heavy rainfall is to highlight the potential biases of climate models and their propagation in the hydrological reaction these "extremes" can cause, such as flood events.

The chosen percentile leads to medians of around 3 to 4mm used to compare model biases on extreme rainfall. This order of magnitude of values is problematic for two reasons:

- It does not show the truly significant positive bias of ICON3km, as can be seen in Figure 6.
- In terms of hydrological consistency, if the objective of this assessment is to compare the biases of ICON3km and ICON11km on extreme precipitation, 2 to 3 mm is not sufficient to produce hydrological responses to short events, and this comparison cannot be informative for drawing conclusions about high flows or floods, knowing that the focus on the paper is the summer convective events.

I recommend reconsidering this percentile threshold in order to compare extreme precipitation values that are meaningful in terms of potential hydrological response representative of summer convective events (99.9th or 99.95th percentile of all hours or 99th or 99.5th percentile of wet hours). You will need to adapt Fig7 accordingly. This will strengthen this part of analysis and give more credit to the evaluation.

4) l309 : Change "discussed" to "shown". Results are discussed later on in the discussion section.

5) l333 : Something is wrong with the statement "2.5-times as high for ICON3km than for ICON11km (1.0 mm to 0.4 mm)". It gives the reader the

feeling of a consistent positive bias for ICON3km for all summer. When looking at Fig S14, we can observe that ICON3km systematically simulates higher daily catchment average precipitation from April to October, but not necessarily stronger biases in summer. July is only a particular case of a bias “2.5 times as high for ICON3km than for ICON11km”, whereas the absolute bias is lower for ICON3km than ICON11km in June and August.

I can advise to replace the Fig S14 by one by seasons to illustrate your point.

- 6) Fig 10 - Why does the maximum relative soil moisture differ for ICON11km and ICON3km ? Intuitively, I would have thought that this parameter would reach the same maximum relative soil moisture when saturation is reached by each of the models. Figure 15 also depicts this. Is there an issue with the reservoir capacity between models ?

In addition, is there a link to the bias differences of hourly ET if the saturation is never reached for ICON11km ?

- 7) Fig S18 : In my opinion, this figure is a main result and is more important for the paper than Fig14. I suggest you switch the figures. FigS18 in the paper body and Fig 14 in Supportive information.

- 8) l461-462 : “leading to a reduction of the flood peak”. This part of the sentence is misleading. The increase of the soil moisture does not lead to a reduction of the flood peak, it shows that the flood could have been worse. There is no causal link between an increase in soil moisture and a reduction in flooding. I suggest rephrasing this sentence as follows: "In fact, the average soil moisture in the hydrological model driven with ICON3km rose, showing the buffering of the large amount of precipitation simulated by ICON3km."

9) l538-539 : “These results agree with the consensus from literature (Lucas-Picher et al., 2021), e.g. with Ban et al. (2021) and Adinolfi et al. (2021).”. I disagree with this statement. The literature you cite shows mainly a reduction in biases in the simulation of extreme hourly precipitation by the CPM compared to the RCM (Fig 7 and Fig 8 of Ban et al. (2021) for a wide range of CPM in Europe). In your study, the CPM changes the sign of the bias from negative to positive for extreme precipitation, with an increase in the absolute bias by the CPM (see Figure 6).

You should rephrase this sentence to take this point into account.

10) l640-641 - This sentence contradicts line 631 “Xie et al. (2025) attributed no added value to the use of their studied CPRCM for hydrological impact modelling”

11) l650-654 - This discussion is interesting and could be enriched by literature on the role of antecedent condition of rainfall-runoff climatic event and their influence on flood intensity (Sharma et al., 2018; Trambly et al., 2019; Wasko & Nathan, 2019)

12) l655 : Why no added value can be found for hydrological modelling ? It is important here to add a statement on the transfer of ICON3km extreme precipitation biases on hydrological modelling, in particular high flows and floods.

13) l686-701 : I think this paragraph should be displaced in its own section in the discussion. Maraun (2016) is another citation that could complete the discussion on bias-correction.

Bibliography

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