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Review Revised manuscript, 22 November 2024

Title: “The European summer heatwave 2019 – a regional storyline perspective”

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Recommendation: [Minor Revision]

### **GENERAL:**

I want to thank the authors for their detailed and extensive reply to the points I raised when reviewing the original manuscript. As far as I am concerned, the authors have adequately addressed most of the issues, leaving just a few points that still require attention, before the manuscript is suitable for publication.

### **REMAINING POINTS:**

1. In reply to my previous point 15 regarding the, in my opinion, improper use of the wording “added value” the authors have removed one “added value” phrase, but retained the rest. In my perception, the reduction in temperature bias when going from the GCM to the RCM is merely the outcome of a using different physics formulations, and also because the GCM apparently performs very poorly for near-surface temperature. I don’t think the higher resolution itself plays a role in the improved skill of the near-surface temperature representation. Unless the authors can make plausible the bias reduction is caused by the higher resolution of the RCM wrt the GCM, I advise to avoid the wording “added value”, and use “improved”, “gain”, ”benefit” or comparable wording.
2. Lines 358-359 (the authors reply to my previous point 28): This is a possible explanation but without testing it remains highly speculative. The 2019 heat wave event was relatively short-lasting and soil conditions prior to the event were not particularly dry (unlike in 2018). In my opinion it is at least equally plausible that the region with highest future warming is slightly displaced with respect to the region with highest temperature in the reference run, because the overlying atmospheric flow pattern with highest temperatures in the future runs is slightly off. It is just very unlikely that the region with highest temperatures in the future runs precisely collocates with that region in the control run, and, thus, highest warming rates will always be found off the centre with highest temperatures in the control run.

Please express that, without testing, the explanation you provide is highly speculative, and that alternative explanations (or combinations of them) are equally plausible.

## OTHER POINTS:

1. Line 65: "from various models or model means". This is a somewhat vague formulation. In practice I would say the deltas are derived "from multi-model ensemble means or single-model multi-member ensemble means" (see de Vries et al. for examples).
2. Line 78: CPM stands for Convection Permitting Models (and not Convective Permitting Models). Please adjust here and throughout the remainder of the text.
3. Line 135/136 (and further down): The word *dynamical* in the phrase "the dynamical year" is somewhat confusing, although I presume it stands for "large-scale dynamical constraints inferred from ERA5". For clarity, please, make explicit what you mean at the first occurrence.
4. Line 135: ".. the 31<sup>st</sup> of September .." → either ".. the 30<sup>th</sup> of September .." or ".. the 31<sup>st</sup> of December"
5. Line 156-157: I could not find a reference of your reply to my previous point 9 regarding the mapping of soil information from ERA5 to ICON in the revised manuscript. Please mention explicitly it in the text, at least including the reference to Prill et al.
6. Lines 159-160: Change "lowermost soil *level*" into "lowermost soil *layer*" (or "bottom soil *layer*")
7. Lines 159-162: Regarding your reply to my previous point 10 (on the meaning of T\_CL) I am wondering if there is a similar treatment of bottom layer soil moisture. Could you spend one or two lines on that?
8. Line 276: "... Autumn" → "early autumn" (simulations stop end of September); I also suggest to change "... other summers ..." by "... the other summer seasons (May-September) ..." (or (MJJAS))
9. Line 355: "should cover" → "should have covered"
10. Line 355: "Nevertheless, ..." → "Still, ..."
11. Caption Figures 3, 7, 8: "five-member" → "5-member"
12. Captions Figures S3 and S4: "a-d" should be "a-c"