

Interactive comment on “Can high-resolution GCMs reach the level of information provided by 12–50 km CORDEX RCMs in terms of daily precipitation distribution?” by Marie-Estelle Demory et al.

Anonymous Referee #2

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Overarching Assessment

This paper compares high-resolution GCM simulations that were produced for High-ResMIP with Euro-CORDEX simulations at a similar resolution. The study is limited to a comparison of the daily precipitation distribution in the two ensembles. Overall, it is novel and interesting, but has a tendency towards making oversimplified statements that needs to be corrected.

General Comments

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1. Without using additional observations, and without the presence of additional high-quality datasets for use, I understand that it is hard to include observational uncertainty. Applying a broad correction to illustrate this uncertainty is a little crude though. I do think it should be included, but lacking a better option, I think you need to better emphasize that this is by no means the ideal way to include an estimate of the observational uncertainty and it is also uncertain. Also, I think calling it a “synthetic dataset” is an unfortunate choice in terminology, as it is not fake or insincere, and I suggest you rethink that choice. At line 359, for example, you could simply say “They are further away from observations, but closer if our measure of uncertainty due to undercatch is considered.”

2. You cite Roberts et al. 2018 (BAMS), but there’s a point they make that I think needs to be highlighted in your discussion as well (see their paragraph that spans page 2342-2343). That is, that high-resolution GCMs are likely to provide improved information at the synoptic scale, and because an RCM’s representation of the large-scale can only be as good as that from the GCM, this implies that high-resolution GCMs may provide better boundary conditions for even higher resolution RCMs. See also Gutowski et al. (<https://doi.org/10.1175/BAMS-D-19-0113.1>) for a similar, relevant follow on discussion to Roberts et al. This point would be relevant, for instance, around line 479, where you make a statement of expectations that I do not agree with and which needs references or a better backup discussion if you intend include it.

3. The authors pose 2 questions around line 150, but only ever address question 1. I suggest either addressing the 2nd question or stating here that this paper will only address question 1.

4. There are a number of statements made in the text that I think are too specific or overly general based on what I see in the presented data. See the “specific comments” section for instances that I particularly think need to be corrected.

Specific Comments

Title: I suggest you change the title to state that you are assessing European CORDEX

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RCMs, as the conclusions could be very different over different regions.

Abstract: The abstract should state that the PRIMAVERA simulations are a part of HighResMip.

Line 25: For the abstract, I suggest removing the reference to bins and making the sentence “We perform this exercise for the distribution of daily precipitation over Europe. . .”

Line 34-35: Instead of “PRIMAVERA appear to be closer to observations. However, when we apply an averaged precipitation undercatch error of 20%, CORDEX become closer to these synthetic datasets.”, you might just say that PRIMAVERA may be closer to the observations in this regard, but that uncertainty exists in the observations due to a potential undercatch error, especially in heavy precipitation. I suggest this, because the reader at this point does not understand why you have chosen the 20% value, and because I disagree with the terminology choice for “synthetic datasets”.

Line 54: The word tuned is used differently by different people and parts of the community; therefore, I suggest you be more specific. I, for one, associate “tuning” with the modification of specific parameter numbers (e.g., changing grassland albedo for your region to something that is known to be more appropriate for your region). It might be more all-encompassing to say that parameterization schemes can be chosen based on their appropriateness for the region and tuning can be completed to better match regional observations. Or, more generally, that an RCM's configuration can be customized to focus on and best simulate the most relevant climate processes of a given region.

Line 59: Remove “so-called”. It has two meanings, the latter of which is not appropriate here and could be misconstrued. 1: a common name for something. 2: a word that is used to describe something that is not suitable or not correct

Line 110: While I partly agree with this statement, it isn't universally correct. I would say that it has “not always facilitated the communication”.

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Line 111: 2-step nesting isn't relevant to this sentence (and not always needed), and convection-resolving simulations are not new, although they have only more recently become more mainstream in climate. I suggest revising this sentence.

Line 118: this implies that RCMs have not also become more complex; however, they too have been moving towards increasing complexity (e.g. Turuncogle and Sannino 2017, <https://doi.org/10.1007/s00382-016-3241-1>)

Line 167: I do not understand this statement, please rephrase: "and concludes with an opening"

Fig. 1: In the caption you reference parts a and b, but there are no a and b labels in the figure. Please modify one or the other for consistency.

Line 250: it is stated that 1000 bootstrap samples are used. Did the authors test this number and its effect on the distributions generated? It is not a very large number of samples, especially considering the input data, and the statement at line 283 suggests to me that it is in fact much too low a number of samples to reasonably sample all combinations. Please justify the use of this particular number of samples or use many more.

Line 255: How were these bins chosen? Are they representative of percentiles or thresholds that impacts users are concerned about? They seem random to me, and 60mm/day seems quite high for the high category for some regions.

Line 270: you should state here if they are in the supplement or not shown.

Fig 4, and other similar figures. The legend placement is sloppy in some of these images. It should be placed where it doesn't cover data.

Line 330: I disagree with the statement that "there is no systematic difference". I see that there is a distinct systematic difference in most regions regardless of season, and so do you, clearly, because you discuss it in the next paragraph. P clearly has more light rain, C has more heavy rain, and the area under the curve is greater in C than P.

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Please be more accurate.

Line 336: the introduction to this sentence is confusing. Do you mean to state that “PRIMAVERA still overestimates low intensity precipitation in all seasons and regions, like CMIP5, although to a lesser extent.”? And if so, where’s the figure that shows that? I can’t tell that it is “to a lesser extent” from the current content.

Line 340: At this point in the text, the statement here is not proven. You should add that this will be discussed later.

Line 345: What is the sensitivity to the results in this paragraph to undercatch error?

Fig. 7. The C and P indicators on this figure are unfortunately too small for the resolution/quality of the PDF, and they are very hard to read, even when zoomed in, because they are so fuzzy. This needs to be fixed.

Line 381: A pie chart including the observational uncertainty would be an interesting addition to the supplementary material, and address my question at line 345.

Line 415: Given how similar PRIMAVERA and CORDEX-44 are, this statement is difficult to verify by just eye-balling the difference between this figure and previous figures. CORDEX-44 and CORDEX-11 are not identical and some of the small differences may matter. Could you overlay all 3 datasets?

Line 445: Not all convective precipitation schemes (CPS) take into account convective inhibition in their triggering function. This makes a difference in the drizzle problem. In my experience, RCMs are more likely to use CPS that include this (in mid-latitudes at least), and GCMs are less likely to. This isn’t tuning, it’s a configuration choice.

Line 483: “over CMIP5-driven CORDEX simulations for precipitation over Europe”. . . this is a bit general. It would be more accurate to say “over CMIP5-driven CORDEX simulations in some regions and seasons by our metrics for precipitation over Europe”

Line 486: Please re-write this sentence, I do not understand at all what it is trying to

say. And, if I guess at what it is trying to say, I do not agree with the statement.

Technical Corrections:

I do not think it should be the responsibility of the reviewer to copy-edit the manuscript. This paper is readable and well-organized, but could use some English language copy-editing. I have pointed out important instances of text in the previous section that I think need to be corrected for clarity purposes though, as these effect the understanding of the science presented. Please pay particular attention those.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-370>, 2020.

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