

Geosci. Model Dev. Discuss., author comment AC2
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Reply on RC2

João António Martins Careto et al.

Author comment on "Added value of EURO-CORDEX high-resolution downscaling over the Iberian Peninsula revisited – Part 1: Precipitation" by João António Martins Careto et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-207-AC2>, 2021

Anonymous Referee #2 on "Added value of the EURO-CORDEX high-resolution downscaling over the Iberian Peninsula revisited. Part I: Precipitation"

General comments to Referee #2

AC: We are very grateful for your kind and positive comments and suggestions. We appreciate all of them. We sincerely think that your revision allowed an overall improvement of the manuscript

RC2: The manuscript assesses the added value of EURO-CORDEX simulations for precipitation over the Iberian Peninsula. The metric "distribution added value" (DAV) is applied for this purpose. The EURO-CORDEX simulations are dynamical downscalings with Regional Climate Models (RCM) of either simulations with a general circulation model (GCM) or a global reanalysis. The DAV is then computed as the percentage change in the Perkins skill score for probability density functions derived from the RCM simulations and their respective lower-resolution driving datasets. As an observational reference for this evaluation, the Iberian Gridded Dataset is used. The manuscript presents original science that fits into the scope of GMD. The Introduction and the description of data and methods are especially well written. The discussion of the results and the presentation of the main findings and conclusions in the last section, however, fall a little bit short.

Specific comments:

RC2: In their description of the results, the authors often use terms like "significant gains", "significant percentages", "significant added value", "more/less significant" and also "very significant". Could you please specify if all these uses of "significant" are to be understood as a purely subjective estimation by the authors, or is it meant that the results are significant relative to a specific, objective degree? Has the statistical significance of the results been computed with a certain reference? Or does it simply mean that the obtained values are "somewhat large"? If the latter is the case, I would suggest to

rephrase accordingly, and not use the term "significant" at all, to avoid confusion with an objectively calculated significance.

AC: We thank the reviewer by raising this issue. In this paper we did not perform any significance test. Thus, the terms "significant" refers to large values. We decided to follow the suggestion and change to "higher", "larger", "notable", "noteworthy" and "noticeable".

RC2: I would suggest to consider phrasings like "larger/higher" or "lower" instead of "strong" and "weak gains".

AC: We thank the reviewer for pointing out this issue and changed the instances with strong/weak into larger/smaller or higher/lower.

RC2: Line 353 is unclear to me. Could you please rephrase or clarify?

AC: We thank the reviewer for this note. We decided to remove the sentence: "For the maximum and minimum temperature extremes, the results are more limited, namely for TASMEN."

RC2: line 376: "gains not as relevant". Could you please clarify the meaning of relevant here?

AC: In this sentence we meant that the models listed have more limited gains in comparison with those listed before. We decided to change the sentence to "On the contrary, the GCMs RCMs pairs that displayed gains not as relevant as those listed before, all display points with limited values and sometimes small losses for sites in the interior, thus lowering the joint performance.

RC2: I believe "Summary and conclusions" would be a better fitting title for the last section, as it begins with a summary of the study, and much of the discussion has been done in the results section already.

AC: We thank the reviewer for the suggestion and changed to "Summary and Conclusions"

RC2: line 436: I am not sure what is meant with "approaching ERA-Interim and CMIP5 GCMs". Could you please clarify?

AC: We thank the reviewer for noticing the issue and decided to remove this part from the text.

RC2: line 437: "uncertainty associated is higher": Could you please discuss a little bit further what kind of uncertainty is meant here, and what this uncertainty means for the results of the study? Can this uncertainty be quantified somehow?

AC: We thank the reviewer for the suggestion. To clarify we changed the statement to "Nonetheless, since unrealistic values may be created, the uncertainty associated to this second approach is higher." This uncertainty is related to the creation of spurious values by downscaling the precipitation field from the low resolution by interpolating it to a higher resolution, thus not considering the effect that topography has on precipitation and land-atmosphere feedbacks. We also added this explanation at the end of the previous sentence: ", not taking into account local feedback systems and the effect that higher resolution topography has on precipitation"

RC2: Line 441: It is stated that "lower-resolution models will shower higher DAV values". Should it not be "downscalings of lower-resolution models show higher DAV"? Apologies if I misunderstood. Could you please clarify?

AC: We thank the reviewer for noticing this issue. We decided to change these lines to:

"While the DAVs metric allows for quantification of the gains or losses by the downscaling of the global models, no relationship is found when the same RCM is forced by multiple GCMs. More importantly a strong connection is observed for high-resolution models driven by the same GCM. The performance of the GCM along the regions of lateral forcing for the EURO-CORDEX plays an important role in the ability of the RCMs to downscale precipitation. This study clearly shows that the gains obtained from the use of higher resolution RCMs are paramount, not only owed to finer details in the representation of variables by itself, but also due to the increased description of orography, and land-ocean-atmosphere feedbacks, which all have important impacts on precipitation."

RC2: I would suggest dividing lines 431-446 into several paragraphs, for the sake of readability. It is difficult to derive the main conclusions from this one big paragraph, which is a mixture of discussions and conclusions. A clearer structure and a sharper rephrasing would help in driving home the main message of this study.

AC: We thank the reviewer for the suggestion and revised the paragraph structure.

RC2: Could you please consider discussing what this study means for future research in this field? I believe you present important results here, and there is a good opportunity to finish the manuscript with a statement on a larger scope, setting the results in context with the aim of the CORDEX initiative, and future efforts in regional climate modelling.

AC: We thank the reviewer for the suggestion and added the following text to the last paragraph.

"The added value associated to the higher resolution gives credence to the growing effort to perform increasingly higher resolution simulations up to convection permitting scales. However, the inter-model variability supports the need for a coordinated ensemble of simulations similar to the one of the CORDEX Flagship Pilot Study on "Convective phenomena at high resolution over Europe and the Mediterranean". Increasing resolution implies higher computational costs; thus, in the last years the CORDEX community identified as a major challenge the objective quantification of RCM added value in respect to the GCM forcing. Added value assessments will allow the detection of future model development needs."

I am looking forward to a revised version of this manuscript.

Please find my technical comments below.

Technical comments:

RC2: Please carefully check the whole text for misplaced commas and the singular/plural use of verbs.

AC: We thank the reviewer for the suggestion and checked the whole text.

RC2: Throughout the manuscript there are several instances of the unit "km" being written as "Km". There is also often a space missing between number and "km".

AC: Corrected.

RC2: line 35: "assessment between" -> either "comparison between" or "assessment of"

AC: Corrected to "comparison between"

RC2: line 36: "Global" -> "global" and use of "PDF", an acronym which has not been introduced yet

AC: Corrected.

RC2: line 43: "become" -> either "has become" or "became"

AC: Corrected to "...has become...".

RC2: Throughout the manuscript: The term should be called "convection permitting", and not "convective permitting". I would also recommend to use either British English or American English throughout the whole manuscript, instead of mixing the two. As for example British: "kilometre", "analysed" and American: "parametrization", "normalization", "~ized"

AC: We thank the reviewer for the suggestions and proceed to correct the whole manuscript with the proposed changes.

RC2: line 92: Maybe an article missing in front of "station-based dataset"?

AC: We thank the reviewer for the suggestion and added the following reference: "ECAD (Klein Tank et al 2002, Klok & Klein Tank 2009)"

RC2: line 143: remove "is"

AC: Corrected.

RC2: line 144: remove comma after "one"

AC: Corrected.

RC2: line 172: "is" -> "are"

AC: Corrected.

RC2: line 173: "behaviour are" -> "behaviours are" or "behaviour is"

AC: Corrected.

RC2: line 210: "of" in front of "ERA-Interim"

AC: Corrected.

RC2: line 213, and other instances: "superior" -> "larger than" or something to similar effect Throughout the manuscript there are many instances in which there is an unnecessary comma in front of the year in paranthesis, as for example in line 218: "Soares and Cardoso, (2018)".

AC: We thank the reviewer for raising this issue and corrected accordingly.

RC2: line 228: Is there something missing between "which" and "display"?

AC: Corrected. We changed "...from which display..." to "...of which they display..."

RC2: line 235: "can't" -> "cannot"

AC: Corrected.

RC2: line 242: "smoothing precipitation field" -> "smoothing of the ... "

AC: Corrected.

RC2: line 288: "The next section" -> "This section", no?

AC: Corrected.

RC2: line 294: "was" -> "were"

AC: Corrected.