

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-294

Anonymous Referee #1

Referee comment on "Extreme events representation in CMCC-CM2 standard and high-resolution general circulation models" by Enrico Scoccimarro et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-294-RC1>, 2021

The paper evaluates the impact of an increase of horizontal resolution on the representation of extreme events in CMIP5 and HighResMIP type models. I think that this could become a valid contribution, but I would like to encourage the authors to extend the evaluation and to provide additional information and plots as outlined in the comments below.

Major:

- The use of "high" resolution for 1 degree and "very high" resolution for ¼ degree is misleading. Why not use "standard" and "high" resolution. Otherwise, you would need to come up with "extremely" high and "ultra" high for the next resolution upgrades.
- To my best knowledge, ERA5 does not assimilate precipitation and precipitation is only available as a diagnostic of 18h forecasts that are used for data assimilation. This is not a big problem, but could you please specify in the text where the precipitation field is coming from? Also, the grid and resolution of ERA5 should be specified (I think it is not ¼ degree).
- I would recommend comparing against two observation datasets for precipitation. This would allow to judge how much (or little) we actually know about mean and extreme precipitation fields.
- The evaluation of extreme events is interesting. But please also discuss the mean temperature and precipitation fields in more detail and include plots of the mean fields and biases. It is difficult to judge the quality of the representation of extreme events if the quality of the mean field representation is unclear. In particular, as you are referring to average representations for temperature and precipitation in the summary.
- Why are you focussing so much on the 99th Please also add plots and discussion of the 90th percentile.
- There should be more discussion on the impact of a resolution upgrade on temperature and precipitation predictions that was observed by other modelling groups. There should also be a discussion how the move to storm-resolving resolutions could change the situation. Furthermore, I would like to know how the parametrisation schemes

change when resolution is increased from 1 degree to $\frac{1}{4}$ degree.

- It is very hard to compare the fields in the figures at the moment. Please put the model fields, the reference (ERA or observations) and the bias fields into the same figure. You can separate 6h/24h and DJF/JJA. At the moment, a lot of flipping through the pages is required to compare the fields.

Minor:

l17: "for the definition of the extreme condition" Please re-word

l21: "for average precipitation"

l26: "lost opportunities" What does this mean?

l29: "GCM simulations" -> Simulations of GCMs"

l178-179: This should be re-worded

Figure 1: This may be an ignorant question, but I guess the 99th percentile could also be for negative temperature values. Whether you are looking into hot or cold temperatures should be specified somewhere.

Figure 5: Please use [mm/d] and not [%].