

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-307

Anonymous Referee #1

Referee comment on "Sensitivity of precipitation in the highlands and lowlands of Peru to physics parameterization options in WRFV3.8.1" by Santos J. González-Rojí et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-307-RC1>, 2021

Sensitivity of precipitation in the highlands and lowlands of Peru to physics parameterization options in WRFV3.8.1

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In their work, González-Rojí et al. present an assessment of the WRF model skill at simulating precipitation over parts of South America, with a focus on parts of Peru, Brazil and Bolivia. The authors explore different configurations of the WRF model, evaluating the performance of the model by comparing precipitation outputs to observations from weather stations and estimates from observation-based products and ERA5. From their analysis, the authors are able to identify which of the studied model configurations work best for their region of interest. In addition, the authors identify some strengths and weaknesses from observation-based products, like PISCO and CHIRPS. The manuscript is well written and the topic is very relevant both for the climate science community of South America and the convection-permitting modeling community. I recommend this study for publication after minor revisions. Please see details below.

Major comments:

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1. Taking further advantage of the high resolution simulations:

Simulations at such high resolution are very valuable for the region of interest. The analysis of the monthly accumulated precipitation is very interesting. A further analysis of 5-day or daily accumulated precipitation would help to strengthen the paper. For example, the analysis of the statistical distributions of the daily accumulated precipitation would help to identify the value of high resolution simulations at representing extreme precipitation.

In addition, in the last section about the diurnal cycle, it would be interesting to add the observations, if hourly data is available.

2. More details about the configuration and domains:

Include some other standard details about the simulations, like the number of vertical levels, model top, type of nudging (if used). In addition, please be more explicit about which of the domains is used in each part of the paper (for example state explicitly whether results from D02 or D03 are used in section 3.4, and so forth).

3. A small extension of the relationship between variables:

Both figures 8 and 9 are very interesting, as they allow to talk about possible relations between variables looking for an explanation about the behaviour of the simulated precipitation. It would be very interesting to see this analysis extended to at least one of the other regions studied in Figure 3. The authors could select for comparison, for example, the regions in flatlands vs. regions over the plateau, or over the slopes, where the simulated cloud field (both in terms of magnitude of cloud fraction and periodicities -e.g. annual and diurnal cycle-) might be qualitatively different.

4. A comment about the order of the sections:

The manuscript is well written, and the sections are clear. However, it seems to me more clear to start with section 3.3, where the mean biases are presented, and then go to sections 3.1 (temporal correlations) and 3.2 (spatial correlations) where second-order metrics (correlations and RMSEs) are studied.

Minor comments:
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L147-149. The authors write:

"Based on previous studies by the authors, the "Europe" experiment includes the updated parameterizations used over that region (Messmer et al., 2017), i.e., Noah-MP instead of Noah land surface scheme".

One could interpret that only the "Europe" run uses the Noah-MP scheme. But in previous lines it is stated that the Noah-MP LSM is used in all runs. Please clarify.

L152-153:

"The "South America" experiment takes as a reference the parameterizations used to simulate storms over the central Andes (Zamuriano et al., 2019)."

The reference to Zamuriano et al. 2019 in

<https://nhess.copernicus.org/preprints/nhess-2019-286/> (search on December 20, 2021) appears as:

"Review status: this preprint was under review for the journal NHESS. A final paper is not foreseen. "

"This preprint has been withdrawn."

Even though the manuscript is available at:

<https://nhess.copernicus.org/preprints/nhess-2019-286/nhess-2019-286.pdf>, the authors should re-consider (o better justify) the citation of this reference.

Throughout the paper the authors use "the parameterization options" when referring to WRF simulations. It would be easier and more standard to read simply "the model" or "WRF", or "run".

Throughout the paper the authors write "monthly precipitation sums". It would be more standard to write "monthly accumulated precipitation".

For example, the sentence:

"The Europe parameterization option simulates especially low monthly precipitation sums in the wet seasons"

could be written:

"The Europe run simulates especially low monthly accumulated precipitation in the wet seasons"

L269-271:

"For 5-day and daily intervals the values drop for the correlations and rise for RMSEs. The increase in the RMSEs and the reduction in the correlations are expected due to the fact that capturing the exact amounts of precipitation at the same time as the observations is rather challenging for the model"

I would not say that this is challenging for the model, but a consequence of sensitivity to initial conditions (internal variability, present even if the model were perfect). These are not weather forecasts, but a continuous climate run.

In Figure 5 you say "The bold numbers indicate the best option for each region". The figure would be easier to read if the corresponding names of the experiments (on the left) were also in bold face.

In addition, usually the symbols like the asterisks used in Figure 5 are used when a correlation is statistical significant.

L336: change from "patters" to "patterns"

Is it possible to add Obs in Figure 8a?

It is not clear to me which domain it is being used for section 3.4 and for the previous sections. For sections 3.1 to 3.3 where the authors using results from D02? Are results of section 3.4 from the D03 domain? Please clarify.

L384. Which is the area for the computation of the field means? The entire D03 domain? Please clarify.

Figs 8 and 9. According to their captions, these figures refer to the NE slopes, but section 3.4 is devoted to flatlands. Please clarify.

In addition, Figure 8 is very interesting. Would it be possible to include a similar figure for some of the other(s) regions studied in Figure 3?

L396-399. The authors write

"The relative humidity and the precipitable water of the No Cumulus parameterization option is especially low, even though the precipitation is comparable to the other options, which might indicate that this parameterization option has an efficient process to remove moisture from the atmosphere, i.e., convective processes. This is also supported by the fact that precipitation occurs mainly in the afternoon, while the other options have precipitation distributed over the whole day (Fig. 9)."

Do the results in Figs. 8 and 9 come from domains D01, D02 or D03?

In case results in Figs. 8 and 9 are from D02 or D03, please explain how the use of No-Cumulus in D01 is affecting the results in D02 or D03. In particular, one would expect that since D02 and D03 do not use a cumulus scheme in any of the simulations, the diurnal cycle would be the same, even in the No-Cumulus run. This is an interesting point that the authors could explain a bit better.

L428-430. The authors write

"The region of interest is the entire department of Madre de Dios, but because of the lack of a dense network of weather stations in that area we evaluate the performance of the model over a broader area including the tri-national border of Peru, Bolivia and Brazil."

I find this comment rather unnecessary. The authors do a fine job at assessing the WRF simulations with the available data for both the broader region in D02 and for the smaller region in D03 (which they say is the region of interest). In this sense, both domains D02 and D03 are the region of interest according to the results and analyses presented in the paper. Maybe the authors could just write something like:

"The region of interest includes parts of the tri-national border of Peru, Bolivia and Brazil, with a focus on the region of Madre de Dios. The analysis of the latter is challenging given the lack of a dense network of weather stations in the area".