

Reviewer's comment on the revised manuscript

"Summertime circumglobal Rossby waves in climate models: Small biases in upper-level circulation create substantial biases in surface imprint" by Luo et al.

### General comments

In this manuscript, the authors assess the representation of mainly wavenumber 5 and 7 patterns in three different climate models (EC-Earth, CESM and MIROC), and search for the reason of model biases with respect to the ERA5 reanalysis data. They find that the models represent these wave patterns reasonably well, however, small biases in the upper level circulation lead to large biases in surface variables, like temperature, precipitation and mean sea level pressure.

In my previous comment, I asked the authors to take care of a few deficits of the paper and to improve the scientific quality by

- 1) increasing the accuracy of the wording and presentation of the results,
- 2) improving the objectiveness related to the used methods and data set, and
- 3) the work should be put in a broader scientific context.

I appreciate the effort of the authors in answering and addressing every single comment. I think that, after the first round of revision, the paper improved a lot. The authors extended the scientific context in which they embed their results, and the objectiveness of the work increased by adding a critical discussion of potential drawbacks of the applied methods. **The accuracy of the wording improved as well, however, there is still substantial need for further modifications. Especially, many recently added parts are unclear and contain several grammatical and technical mistakes. In my opinion, although the nature of mistakes is mostly minor, they are almost unacceptable for a revised manuscript. Thus, I ask the authors again to revise the text thoroughly, otherwise I cannot recommend the acceptance of this paper by WCD.**

### Specific comments

L224-227:

*"... the v250 field is shown in absolute values, together with surface variables in anomalies with respect to climatology mean"*

You mention this a few lines above (L217-218).

*"The same analysis is carried out ... during wave 5 and 7 events (see Appendix Fig. B10 and B11)"*

Which analysis exactly? Too unclear, please reformulate.

*"By comparing Fig.3 and Fig.4 to Fig. B10 and Fig. B11, the observation can be obtained that the spatial patterns of v250 do not differ much"*

Instead of writing "comparing Fig. X and Fig. Y" please write what you are comparing exactly in terms of the figure contents. You could write, for example, that you compare the anomalies corresponding to wave 5 and 7 events with the ones obtained for the other wave events. Written in this form, it becomes

easier for the reader to understand your message.  
Please rephrase “*the observation can be obtained*”.

Overall, please rephrase this recently added part of the paragraph: don’t write the same several times, formulate the message in a clear way and be sure that the new text fits well to the rest of the paragraph.

L229-232:

“Furthermore, Fig. 3 and Fig. 4 with *significant tests at confident level* of 95%, as well as False Discovery Rate (FDR) method (Benjamini & Hochberg, 1995) were applied in Fig. B12 and Fig. B13.”

You actually write here that you apply Fig. 3 and 4 in Fig. B12 and B13, which makes no sense. Please reformulate.

“Significance test” instead of “*significant test*” and “confidence level” instead of “*confident level*”.

“Areas with highlighted fuchsia color *are the locations passed the significant tests*”

Locations do not pass the significance test, instead the differences over those areas are significant. Additionally, the sentence grammatically incorrect. Please rewrite.

Please rephrase the whole paragraph. You could incorporate it in the rest of the text because there is no new scientific message here, instead it points out that some already presented results are significant.

Fig. B12 and B13: please rewrite captions (“significant applied at...” ??).

Remark regarding emergent constraints: The option of emergent constraints based on observational data should be considered with caution, see for example Sanderson et al., 2021, Earth Syst. Dynam.

### Technical corrections

L156: Instead of “the weeks are” “the numbers of weeks are”.

L206: “*can be found at Fig. B2*”. Please rephrase.

L299: “*Still in For t2m*” ?

L322-323 “the” is missing before “soil moisture part” and “overall bias”.

L329: “*wave-7*” appears twice.

L358-359: “*has little effect on the representation of circumglobal waves nor their surface imprint, or, at least not on the anomaly these events produce.*”

“has little effect on the representation of circumglobal waves **and** their surface imprint, or at least **on** the anomaly these events produce.”

L367: “*for during*” ?

L372: “*Since its on hemispheric scale...*” Incorrect formulation, please rephrase. “Its” is a possessive pronoun.

L373: “Depending on the stationarity of the dataset, the results can also differ substantially with FFT method.” What do you mean?

L382-383: Please move “*patterns*” to the end of the sentence.

L392: “flow” instead of “*slow*”. I pointed this out in the previous review already.

References: I’m sure it’s “Röthlisberger, M.” instead of “*Röthlisbergera, M.*”. This is also something I mentioned in the previous review as well.

Fig. B2 caption: “Same as” instead of “*Same with*”.

Figure captions: “*seal level pressure*” is written instead of “sea level pressure”.