

Weather Clim. Dynam. Discuss., referee comment RC2
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Comment on wcd-2021-48

Anonymous Referee #2

Referee comment on "Summertime circumglobal Rossby waves in climate models: Small biases in upper-level circulation create substantial biases in surface imprint" by Fei Luo et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-48-RC2>, 2021

This study compares model errors with a set of nudging experiments using multiple AGCMs. They find nudging the upper-level circulation can significantly reduce surface biases, while nudging soil moisture can't lead to much improvement. This is a very interesting study that definitely deserves to be published. However, the interpretation and presentation may need some extra efforts. Below I list several concerns, mostly minor, for consideration during the revision process.

- Total field or anomalies. I get confused at different parts of the manuscript whether they were talking about the total field or the anomalies of v_{250} . Wavenumber 5 and 7 may be more prominent and longitudinally phase locked in the total field, but it's unclear whether this is also true for the anomalies. I am afraid that for subseasonal variability and extreme events, what matters more is the anomaly, not the total field. I can't help wondering why they chose to only focus on events that project strongly onto wavenumber-5 and -7 of the total field.
- It would be far stretched to use the current experiments to address Question 3, whether model biases originate from the atmosphere circulation or land surface-feedbacks. First, prescribing soil moisture does not necessarily mean the model can accurately simulate land-atmosphere feedback. Secondly, it seems that the nudging they applied to the atmosphere circulation (above 700 hPa) is far more than just "the upper atmospheric levels". Therefore, they may need to rephrase the conclusion that "small bias in the upper atmospheric levels can result in big bias in surface weather conditions" (ln 305). See 4. for another concern on drawing this conclusion.
- Why are the pattern correlation coefficients in Figs. 5,6 all positive? What's the geographical domain used to construct the Taylor diagrams?
- Why unlike other three models, CESM (Fig.B1) B_{land} is not much smaller than B_{atm} ? In fact, why are the magnitudes of B_{tot} , B_{atm} , B_{land} and B_{res} rather similar?
- Significant test for the composite maps in Figs.3,4 is needed.
- The manuscript needs serious editing.