

Non-Hydrostatic RegCM4 (RegCM4-NH): Model description and case studies over multiple domains

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We thank the Reviewers for the time dedicated to the second review of the manuscript. We have revised the whole manuscript following their useful comments, which are point-by-point addressed below.

Referee #1

The revision really improves the quality of this paper, however a carefully language check is still needed, for example, the “Era-Int” or “ERA-Interim”. Some minor revisions are needed, especially on figures.

1. Figure 9: The high-resolution simulations always show strong vertical motion and accompanied convergence. It may be more proper to use different scale for 3-km and 12-km simulations, then the vertical and horizontal motions in the 12-km simulation can also be clearly shown. Shading not contours make it more aesthetic?

Response: We have tried using shaded contours instead but this makes it difficult to see the arrows. The arrows have been made bolder now along with the contour lines to improve the readability. About the horizontal scale, we believe it is important to keep a consistent scale between the 3km and 12km simulations so that it is easy to see the difference in the circulation in both. One of the points we make in this section is that the new 3km simulation has a stronger circulation response to convection, so it is important to show this comparison in Fig. 9.

2. Figure 10: zonal anomalies may help to highlight the lake-land differences.

Response: Done. Temperature anomaly are now displayed that better highlight the day-night and the lake-land contrast

3. Figure 3 caption: L369 “(c)” should be “(b)” **Response:** Right. Corrected.

4. Figure 6 caption: “by the red square in Figure 3 (a,b)” ? **Response:** This has been corrected. The black squares in figures 5a and 7a.

5. All the ocean and lake coastlines should be thick enough

Response: Done. Lake/Ocean coastlines have been plotted thicker to improve figures readability

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Referee #2

This is the 2nd round of review for this article.

General comments:

- The manuscript improved a lot since the first round, but there are still a couple of language issues (some examples will be given later). I think the authors could improve by formulating shorter sentences. Many hard to understand formulations come from long sentences with many subclauses. Especially in the section about Lake Victoria this becomes an issue.

Response: Done. Text has been revised to improve readability.

- Some figures still need improvements in terms of readability. Many contain latitude/longitude information that are too small to read.

Response: Most of figures have been revised for improving readability

- Please double check how dates and times are written. For dates it should be either June 12 or 12th of June, but not 12 June. Is the time of the day in all cases local time? For Lake Victoria you explicitly state 12Z (better would be 12:00Z), which I would refer to UTC. Later in that section (Figure 10) you write something like "25Nov h:06". Is this UTC, too? I don't want to be too picky here, but at least it should be consistent throughout the paper.

Response: the dates and time are uniformly written now.

- Please add degree signs to latitude/longitude information.

Response: Done. Coordinate labels are shown with West (W) and East (E) lettering.

- Figure 9+10: The section around Figure 9 and Figure 10 (L561-L580) is very ambiguous to me. This needs much better explanation including the captions. Some unclear points are detailed below.

Response: Text has been revised and in particular Figure 9 captions improved. Figure 10 has been replaced as suggested by reviewer #1, now showing more clearly lake/land and day/night gradients as reproduced at the two resolutions through surface temperature zonal anomaly.

Specific comments:

L342: is not there -> is lacking **Response:** Done

Figure 3: lat/lon information too small. The caption needs to be rephrased. **Response:** Done

L376: Figure 3 -> Figure 3a **Response:** Done

L387: upslope flow Raplh et al. (2006) -> upslope flow (Raplh et al., 2006) **Response:** Done

Figure 4: The units for mslp and surface temperature are missing. Numbers at the colorbar are too small. Arrow legend is too small. **Response:** units for mslp and surface temperature have been added in the caption. We have increased the size of the colorbar numbers and of the arrow legend (as well)

L429: delete blank after precipitation. **Response:** Done

Figure 5: Please add letters to the sub-figures and update the text accordingly. lat/lon information too small. **Response** : Done. We have labeled panels and improved plot readability.

Figure 6: Please add latters to the sub-figures and update the text accordingly. **Response:** The letters are already indicated in the previous version

Figure 7: Please add letters to the sub-figures and update the text accordingly. lat/lon information too small. **Response:** Done. We have labeled panels and improved plot readability.

L552: Do you mean Figure 8a? **Response:** Right. Corrected.

Figure 8: The units for mslp and surface temperature are missing. Numbers at the colorbar are too small. Arrow legend is too small. **Response:** units for mslp and surface temperature have been added in the caption. We have increased the size of the colorbar numbers and of the arrow legend (as well)

L564: right panel of Fig. 8 -> Fig. 8b) **Response:** Corrected.

L566: differential -> difference **Response:** Corrected.

Figure 9: Please add unit for the y-axis. The caption needs a rework. See details in following comments. **Response:** Done. The figure caption has been revised pressure/units label added to the y-axis. Some figure aspects have been revised to improve the readability .

L583: Where do I see a red line in Fig. 9? Do you mean the black line in Figure 8b)? **Response:** Right. Corrected.

L584: Which zonal-wind anomaly is meant here? This is not explained anywhere else. Why is the mean of 0-2N (I assume 0°-2°N) shown when the cross-section is at 1°S? **Response:** Caption has been revised and information on the zonal-wind anomaly added to the section which introduces this figure. The zonal-wind anomaly is (0°-2°S) and was incorrect in the caption. Corrected now.

Figure 11: Please add letters to the sub-figures and update the text accordingly. lat/lon information too small. What are the contours? Which unit? **Response:** Done. Units for precipitation have been added in the caption.

L611: climatology -> climatologies. **Response:** Done

L617: Please rephrase that sentence. **Response:** Done. We rephrased to clarify. “However, despite the large uncertainty among the different observed datasets (Figure 11 a-d), we find a significant underestimation of the precipitation by the 12 km run over the lake independently of the dataset used as a reference (Figure 11f).”

L634-637: This sentence does not make sense. **Response:** We rephrased and corrected the typo of MM5 instead of MM4 hydrostatic core. “The non-hydrostatic dynamical core of MM5 has been thus incorporated into the RegCM4 system previously based on the MM5 hydrostatic core.”

L651: convection permitting -> convection-permitting **Response:** Done

L657-659: What do you mean with short time scales? Do you refer to events of short duration, e.g. sub-daily heavy precipitation? With this I could agree. Maybe you can rephrase this sentence. **Response:** Right, we intended sub-daily instead of short. This has been corrected in the text.