

## RESPONSE TO REVIEWER 1

REVIEWER COMMENTS	RESPONSE OF AUTHORS
<b>1 Overall Recommendation</b>	
<p>The research paper investigates the impact of warming on rainfall changes in damaging Philippine typhoons using high-resolution convection-permitting models with pseudo-global warming methods. It advances the understanding of tropical cyclone (TC) landfall rainfall hazards in the Philippines. However, several improvements are needed before recommending acceptance</p> <p>I recommend a major revision, with particular attention to:</p>	<p>We sincerely thank the reviewer for the valuable comments, which has greatly helped improve the quality of our manuscript. We appreciate the reviewer's recognition of our study's contribution and agree with the recommended revisions.</p> <p>We have provided point-by-point responses to the comments and describe the corresponding revisions made to the manuscript.</p>
1) the defining of TC inner core	The TC inner-core definition has been clarified and consistently applied across analyses (see revised Section 2.4). We now adopt a 1° radius definition following the reviewer's suggestion. We also added some discussion for an outer radius of 2.5° from the center.
2) Quantifying future changes in TC rain rates due to dynamic (e.g., TC intensity increase) and thermodynamic (e.g., water vapor increase) factors, including their relative contributions to inner core rainfall changes (100 km radius).	We have done additional analysis from our existing experiments to quantify the relative thermodynamic and dynamic contributions to the inner core rainfall changes using the physical scaling diagnostic proposed by Yang and Toumi (2025). We will add this in the results and discussion session.
3) Using a consistent rain rate unit (mm/hour), as the mix of mm/day and mm/6-hour confuses readers.	All rainfall rates throughout the manuscript have been standardized to mm h <sup>-1</sup> , including all figures and text references, except section on Daily total accumulated rainfall
<b>2 MAJOR COMMENTS</b>	

<p>The section “ Changes in TC rain rate and intensity in the simulations ” discuss rain rate change inadequately.</p> <p>Can you please show the simulation time series of inner core rain rate just like Figure 2 expect shows the rain rate.</p>	<p>We have added a new figure showing the time series of simulated inner-core rain rate for each case, analogous to Figure 2.</p>
<p>Can you depose the change of TC rainfall rate to thermodynamic and dynamic contribution to see whether the moisture increase or TC intensity dominate the rainfall change. You can follow Yang and Ralf (2025) (DOI 10.1088/1748-9326/ad d753).</p>	<p>We have done additional analysis from our existing experiments to quantify the relative thermodynamic and dynamic contributions to the inner core rainfall changes using the physical scaling diagnostic proposed by Yang and Toumi (2025). We will add this in the results and discussion session.</p> <p>However, we cannot perform additional idealized experiments as in Yang and Toumi (2025), because our experiments are already complex ones, in ensemble mode, and additional experiments would be computationally expensive and would require very substantial additional time for processing output and performing analyses.</p>
<p>Figure 11, In the discussion, perform linear regression separately for the Pre-industrial and future climate.</p> <p>Mixing Pre-industrial and future climate together results in no meaningful results. A recent study (Chen et al., 2025, <a href="https://doi.org/10.1029/2025GL116146">https://doi.org/10.1029/2025GL116146</a>) suggests that in a warming climate, a <math>1 \text{ m s}^{-1}</math> increase in TC intensity corresponds to a higher increase in rain rate because of increased moisture. This result was performed in coarse-resolution GCM. Please explore whether this is valid in your simulations.</p>	<p>Thank you for this important suggestion. We have revised Figure 11 to perform separate regressions for the pre-industrial and future climate simulations. This separation reveals a clearer relationship between intensity and rainfall rate consistent with Chen et al. (2025).</p> <p>We also discuss how, in our high-resolution simulations, the slope of this relationship increases under future warming, consistent with Chen et al (2025) findings in coarse-resolution GCMs.</p>

<p>Rain rate mismatch exist broadly in your article, like Figure 6, 7, 8, 9. I suspect whether the rain rates in Figure 7, 8, 9 are plotted correctly. It seems there are moving TC center in your Figure 7, 8, 9. The precipitation rate is calculated using difference in 6 hour accumulated rainfall? Probably using difference in 1 hour accumulated rainfall by increasing model output frequency.</p> <p>The 6 hourly accumulated rain difference may falsely enlarge the intense rainfall region due to movement of TC itself. Please use hourly accumulated rain difference. With hourly accumulated rain difference, a compacted intense rainfall (100 km radius) is likely to be found. And 2.5 degree is too large for defining inner core.</p>	<p>All rainfall rates throughout the manuscript have been standardized to <math>\text{mm h}^{-1}</math>, including all figures and text references.</p> <p>The TC inner-core definition has been clarified and consistently applied across analyses (see revised Section 2.4). We now adopt a <math>1^\circ</math> radius definition following the reviewer's suggestion. We also added some discussion for an outer radius of <math>2.5^\circ</math> from the center.</p>
<p>Lots of experiments have been done in this study. Please use a table in the methods section to outline all your conducted experiments, including key information about these experiments.</p>	<p>We have added a summary table (Table 2) in the Methods section (Section 2.1)</p>
<p><b>3 Minor Comments</b></p>	
<p>Line 1 (Title): I suggest incorporating warming impact on changes and removing PGW. A revised title could be: "Impact of warming on rainfall changes in damaging Philippine typhoons using high-resolution convection-permitting models."</p>	<p>Title revised as suggested.</p>
<p>Line 49: I did not find the corresponding references of Wang et al. (2014, 2015) in the Reference section. Also, I noticed that the author name does not match the article titled 'Super Clausius–Clapeyron scaling of extreme hourly convective precipitation and its relation to large-scale atmospheric conditions'.</p>	<p>References corrected and verified; appropriate citations added to the Reference section.</p>
<p>Line 60: "Recent literature describes . . ." is better replaced with "Recent studies report . . .".</p>	<p>Revised as suggested.</p>
<p>Line 62: "rainfall rates within a 100-km radius" would be more precise if changed to "average rainfall rates within a 100-km radius".</p>	<p>Modified accordingly.</p>
<p>Line 75: "the study hopes to provide additional evidence". It is better to delete 'hopes to'. I</p>	<p>Deleted "hopes to" for a more confident statement.</p>

believe the article provides such additional evidence.	
Line 129: TC inner core region is defined typically using distance like 1 degree, or 100 km or twice of radius of maximum wind. I suggest to defining inner core also using 1 degree to see whether results have changed.	We now adopt a 1° radius definition for the inner core rainfall. We also added some discussion for an outer radius of 2.5° from the center.
Line 166: In terms of Figure 2 (middle panel), BOPHA in the future climate indeed shows weaker rainfall and relative humidity than the current climate during some hours. Do you have any ideas why this occurs?	We have updated this discussion based on the updated figures, showing consistent increase in rainfall under future climate for Bopha.
Lines 166–170: Considering that BOPHA in the future climate indeed shows weaker rainfall and relative humidity, it may not be suitable to simply state that ‘Under future climate conditions, accumulated precipitation consistently and markedly increases relative to the current climate’. Try to be more precise in describing the contents in Figure 2.	Revised statement to reflect case-dependent variability in precipitation changes.
Line 168: Remove the excessive dot before ‘Similarly’.	Corrected.
Line 207: Figure 4 lacks units on the y-axis (‘total accumulated rainfall’), and also provide unit information in the Figure 4 caption.	Units (mm) added to both figure and caption.
Line 223: The unit should be corrected.	Revised the figure and corrected the unit
Line 213: Why did you choose to use daily TC rain rate instead of hourly rain rate or 6-hour rain rate as discussed in Figure 6? I suggest using a consistent rain rate metric.	All rainfall rates throughout the manuscript have been standardized to mm h <sup>-1</sup> , including all figures and text references. The discussion in the text is also updated.
Figure 4: I suggest creating a box plot for total accumulated rainfall over multiple averaging radii, such as 500 km and 100 km. The 500 km averaging radius is typically used to account for the total TC rainfall area. The 100 km averaging radius is used to account for the TC inner core rainfall.	Added new Figure 4 with boxplots for 1° averaging radii.
Figure 4: Also lacks units in both the caption and the figure.	Added units (mm) to both figure and caption.

<p>Figure 6:</p> <ul style="list-style-type: none"> <li>• 1) Please consider a logarithmic scale for the y-axis.</li> <li>• 2) Please label your subfigures properly using a format like a), b), c).</li> <li>• 3) Please set your title for the x-axis properly.</li> <li>• 4) What does “the black” mean? The last sentence of the figure caption is not finished.</li> <li>• 5) The legend colors do not align with the corresponding colors.</li> <li>• 6) The x-axis title shows 3-hour rain rate, while the main text shows 6-hour rain rate.</li> </ul>	<p>Figure 6 revised completely, added log-scale, proper subfigure labels, axis titles, corrected legend, and completed caption with consistent rain rate units.</p>
<p>Line 226: The sentence “Figure 6 shows the boxplots of percent changes in mean, 95th, and 99th percentiles of 6-hourly rainfall rates for Haiyan, Bopha, and Mangkhut relative to the current climate scenario” is not accurate.</p> <p>Change it to “Figure 6 shows the boxplots of percent changes in mean, 95th, and 99th percentiles of 6-hourly rainfall rates for Haiyan, Bopha, and Mangkhut of the Pre-industrial and Future simulations relative to the current climate scenario”.</p>	<p>Revised the sentence as suggested.</p>
<p>Lines 227–231: You compared future simulations with the current climate; however, the comparison between Pre-industrial and current climate is ignored, although it seems that the Pre-industrial shows increased TC rainfall rate (e.g., 99th percentile).</p>	<p>Added comparison between Pre-industrial and Current simulations in Section 3.4 and discussed implications.</p>
<p>Figure 11: Please show the slope, correlation coefficient, and p-values for both a) and b).</p>	<p>Added slope, correlation coefficient, and p-values in both panels and described in caption.</p>
<p>Figure 11: Please show units of rain rate and TC intensity in the caption. Please clarify how you defined ‘inner core’—using a 100 km averaging radius, or 2 times the radius of maximum wind, or otherwise.</p>	<p>Added units (<math>\text{mm h}^{-1}</math>) and clarified definition of inner core (<math>1^\circ</math> radius).</p>
<p>Figure 11: The legend is too small. I suggest splitting the legend into two parts in Figure 11 b) if there are too many.</p>	<p>Adjusted legend size and layout</p>

Also, define short names for model setups which can be consistently referenced throughout the paper, such as referencing Haiyan as HY.	We have updated Table 1 to introduce the different model setups and retained the 5kmCU and 3kmNoCU but did not use short hand names for the TCs since there are only three TCs.
Figure 12 is not well interpreted in the main text. There should be some discussions regarding Preind-Ctrl in your main text.	Added new discussion on Preind-Ctrl differences in Section 3.4.
Figure 12: The units (dBZ) and experiment setups are displayed in the subfigure titles. You can probably improve the figure by clarifying units and experiment setups in proper locations.	Improved layout with unified colorbar and clarified units (dBZ) and experiment labels.
Line 317: What does “deep core convection” mean? Or is it deep convection?	Revised to “deep convection.”
Line 332: Add a blank space after (Hendricks et al., 2010).	Revised
Line 421: Can you clarify the increase up to 25% at what scenario? And what is the percent increase per degree of warming?	Clarified that the increase corresponds to the Future scenario; added percent increase per °C of warming in Section 4.