Response to Review 4 (CC1-Jimmy Fung):

The authors presented a thorough storyline-based analysis over the Pearl River Delta under future conditions using Pseudo-Global Warming (PGW) modeling techniques. They perturbed the historical initial and boundary conditions obtained from ERA5 reanalysis and handed to the regional model WRF according to the climate change signal projected by the CMIP6 ensemble under SSP5-8.5, in which each of the 16 selected CMIP6 models acted as the basis for an individual storyline of future typhoon intensity. Results indicate a general increase in typhoon intensity across all metrics for six of the seven inspected typhoons. This increase is notably higher for specific storylines, and the projected increase in the extreme values of the inspected metrics significantly exceed the median change of all storylines. Overall, the manuscript is well-written and well-organized, and is equipped with a large workload and high-quality numerical experiments as key supporting materials. I believe the method is scientifically valid and the results are logical and reasonable. Based on the current phase of the manuscript, if the authors can properly address the following comments, I would recommend accepting it for publication.

Reply: We thank Reviewer 4 for the positive feedback. We are trying our best to address the comments and make the necessary revisions. We hope to have the option to submit a revised version of our manuscript and receive your recommendation for final acceptance.

Minor Comments:

Comment: The authors utilized CMA and JMA best track data to evaluate the model's performance. Meanwhile, the Hong Kong Observatory (HKO) also provides best track data for tropical cyclones that affect the PRD. Due to Hong Kong's geographical location, HKO's best track data is generally considered to be of high quality for the PRD region. If it does not require a significant amount of extra work, the authors may want to consider comparing their results with HKO's best data in Figures 4 and 5.

Reply: We thank Reviewer 4 for sharing with us the information about best track data documented by the Hong Kong Observatory (HKO).

We have downloaded the tropical cyclone best track data by following the link https://data.gov.hk/en-data/dataset/hk-hko-rss-tropical-cyclone-best-track-data.

In this revision our results are compared with HKO's best track data, in addition to CMS's and JMA's best track data, and Figures 4 and 5 are updated accordingly. Discussions about the uncertainties associated with these three best track datasets are added into the "4 Discussion" section.

Comment: The CMA best track archives the 2-minute average maximum sustained wind speed at the 10-meter level, while JMA archives 10-minute values. On the other hand, the default output for WRF is the instantaneous wind speed of the grid area mean, which may be related to the integration time step and grid area. It would be helpful if the authors could clarify how they compared these different definitions of wind speed, and whether they used any conversion coefficients.

Reply: For our WRF simulations, we saved the default outputs at an hourly scale, which includes, among other variables, instantaneous wind speed and accumulated precipitation. In addition to the default outputs, we saved diagnostics outputs (statistical values) for surface variables such as wind speeds at 2-minute intervals, aligning with the definition of wind speeds documented in the CAM best track. These diagnostics, saved at a high temporal frequency (i.e., 2-minute), allow us to compare the simulated winds speeds with those documented by different agencies in a statistically consistent manner, without needing to apply conversion coefficients.

Our evaluation strategy has been added into the "Data and Methods" section.

Comment: The authors employed spectral nudging to enhance the performance of TC tracks. Although the authors have justified that the nudging operation does not affect the inner core of the simulated typhoon, studies have shown that nudging in perturbed experiments may limit the intensity of TCs (Moon et al. 2018; Li et al. 2024). Therefore, it is a trade-off to turn on nudging to reproduce

comparable TC tracks in the PGW experiments. The authors may want to consider discussing this in L250-255.
Reply: We fully agree with the Reviewer that using spectral nudging involves a trade-off in reproducing comparable TC tracks in the PGW experiments.

We have rephrased this sentence to better acknowledge the impact of spectral nudging on the simulated typhoons, especially in the PGW experiments. Additionally, we conduct a quantitative analysis of the spatial changes in simulated typhoon tracks due to climate change, focusing particularly on runs without spectral nudging. We also discuss the uncertainties in the results related to the application of spectral nudging.

Comment: L165: Please give specific reasons for the preference of using grid-cell basis compared to spatial mean.
Reply: The preference for using a grid-cell basis rather than a spatial mean stems from our aim of capturing the spatial (horizontal and/or vertical) variability of climate change signals.

This consideration is important because our simulation domain is relatively large, approximately $2.5*10^7$ km^2. Global warming signals vary regionally across such a large domain and differ between global general circulation models as well.

Justifications for our preference for using a grid-cell basis over a spatial mean have been added in the revised "Data and Methods" section.

Comment: L175-180: Although seven selected typhoon events did not occur in May and June, it is still valuable to fill the 2-month gap in Figure 2 to give a complete picture of summer-time seasonal cycle of global warming signal for readers' reference.
Reply: As suggested, the May-June 2-month gap has been filled in the updated Figure 2 for reader's reference, so that a complete picture of summer-time seasonal cycle of global warming signal is given in the revised version.

Comment: L210: The authors have provided a justification for using WRF instead of HWRF. However, it is important to note that the ocean coupling effect, such as cold wake feedback and wind-sea wave interactions, may also impact the intensity of TCs, which cannot be captured by WRF-only simulations (e.g., Mogensen et al. 2017; Magnusson et al. 2019; Li et al. 2022). Therefore, the authors may want to address some of these limitations in their study.
Reply: In this revision we have followed the Reviewer's suggestion and have acknowledged the limitations of our WRF-only simulations by expanding on the following aspects:

- Representation of air-wave-ocean interactions;
- The need for coupling with an ocean model and/or wave model;
- Limitations regarding operational real-time hurricane forecasting.

The above-mentioned aspects concerning the limitations of our WRF-only simulations have been further elaborated in the revised "4.3 Limitations of the study design" section.

Comment: L230-235: The authors utilized the Rapid Radiative Transfer Model (RRTM) for longwave radiation and the Dudhia scheme for shortwave radiation in their WRF configuration. To the best of my knowledge, RRTM shortwave scheme is typically used in conjunction with the longwave radiation scheme. Therefore, it would be beneficial if the authors could provide a justification for why they did not use the RRTM shortwave scheme in their study.
Reply: We agree with the Reviewer that the RRTM shortwave scheme is typically used in conjunction with the RRTM longwave radiation scheme. However, our choice is based on extensive literature research.

Our justifications for using the Dudhia scheme rather than RRTM for shortwave parameterization are as follows:

- Under clear-sky conditions, several WRF model evaluation studies have shown that the simpler Dudhia shortwave radiation scheme outperforms the more complex RRTM shortwave radiation scheme (Ruiz-Arias et al. 2013; Zempila et al. 2016; Chen et al. 2017).
- In cloudy-sky and precipitating conditions, the combination of the Dudhia shortwave and RRTM longwave schemes is commonly used, for example, in reproducing the East Asian monsoon (Wei et al., 2015), the West African monsoon (Klein et al., 2015), and warm-season precipitation over Europe (Arnault et al., 2018).
- Under extreme weather conditions, this radiation combination has been employed to simulate typhoons over the western North Pacific (Sun et al., 2019; Wu et al., 2024) and the North Atlantic (Perez-Alarcon et al., 2024).

We acknowledge that the combination of the RRTM shortwave and longwave schemes is also used for simulating Typhoons (Li et al., 2022). However, we think that the uncertainties steaming from the selection between RRTM and Dudhia are negligible compared to those associated with the choice of for example cumulus schemes (Tian et al., 2021).

Our justifications for using the Dudhia scheme have been added in the revised version.

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Reply: The recommended literatures have been cited in the revised version.