This manuscript presents TCG-Net, a deep-learning-based framework for the reconstruction of the tropical cyclone genesis (TCG) distribution over the western North Pacific (WNP). The authors introduce two task-specific labelling strategies, combined with temporal feature enrichment and imbalance-aware training, to extract both seasonal and spatial characteristics of TCG directly from MERRA-2 reanalysis data. The effort put forth by the authors is commendable, but the manuscript requires significant revision. In particular, clearer clarification is needed on the applicability of TCG-Net, the definition and climatological representation of TCG, the claimed physical novelty. Before considering this paper for publication, I have several concerns and suggestions outlined below.

Major comments

1、TCG-Net is an application-oriented framework, yet its practical strengths and limitations relative to existing approaches are not sufficiently clarified. The authors claim that vortex tracking methods face challenges with coarse-resolution climate models (>0.5◦) and TCG-Net therefore serve as a complementary tool. In fact, several traditional detection algorithms has been developed for coarse-resolution datasets, such as OWZP and TRACK (Tory et al., 2013; Hodges et al., 2017), which exhibit reliable performance in reproducing the climatological distribution of TCG in both reanalysis datasets and climate models (Bell et al., 2019; Bourdin et al., 2022). A comparison between TCG-Net and traditional detection algorithms would be valuable.

2、TCG-Net was not developed based on objective TC structural characteristics, but rather on large-scale environmental factors in present-day climates, similar to GPIs. As a result, the applicability of TCG-Net to future climate projections is uncertain, as the relative importance of critical environmental factors may change under warming conditions (Murakami and Wang, 2022).

3、The authors use the TCG distribution derived from 2017–2022 to represent “TCG climatology,” which may not be appropriate. Given the strong interannual variability of TCG, a five-year period is generally insufficient to characterize climatological conditions.

4、In this study, TCG was defined as the first time that a TC was recorded in observations, which can be reasonable in a weather prediction context because it allows earlier detection of cyclogenesis. However, in climatological studies, TCG is more commonly defined when the storm intensity first reaches 35 kt in order to exclude weak or short-lived vortices (Klotzbach et al., 2022; Lai and Toumi, 2023). How sensitive the performance of TCG-Net may be to the definition of TCG?

5、While the authors emphasizes novelty in terms of large-scale environmental drivers of TCG, the selected large-scale factors based on feature ranking are largely consistent with previous studies (Emanuel, 2010; Wang and Murakami, 2020). In this regard, the results appear to largely reproduce established findings rather than provide genuinely new physical insights, and the claimed level of innovation in this aspect may be overstated.

6、I was a little confused about domain chosen in this study. While a positive TCG label was defined as the square box of size 18°×18° centered on the first recorded TCG location, the ResNet-18 model was applied on each 5°×5° box. It is therefore unclear how the labeling domain and the prediction domain were reconciled during training and evaluation.

Minor comments

1、L95: Another advantage of choosing MERRA-5 is that TC-related information has been assimilated into MERRA-5, whereas ERA5 does not include this (Gelaro et

al., 2017).

2、L114: IBTrACS database compiles global TC tracks information from multiple agencies. Which agency's observations were utilized in this study?

3、L179: Change “DM” to “DD”

4、L362-363: The discrepancy between the DL model results and observations may not solely reflect limitations in DL model optimization, but could also arise from deficiencies in the ability of large-scale environmental factors to reproduce the seasonal variability of TCG (Menkes et al., 2012; Tippett et al., 2011).

5、L375-381: The pattern correlation coefficients with the observations are encouraged to quantify the performance of the DL model.

6、L432: The pressure levels described here is inconsistent with the Table.4

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