General Comments:

This study investigates stratospheric gravity waves generated by Typhoon Soudelor (2015) using WRF simulations to evaluate the sensitivity of various physical parameterization schemes. While a high-resolution simulation of such a well-observed case is potentially valuable, the current manuscript lacks scientific novelty and fails to meet the rigorous standards established in previous studies.

The fundamental issue is that while the authors observe high sensitivity among different schemes, they provide little to no physical explanation for these variations. Furthermore, the experimental design is poorly balanced: although diabatic heating is identified as the primary driver of TGWs, the sensitivity tests are disproportionately focused on PBL schemes rather than a comprehensive range of Cumulus Parameterization (CP) or microphysics options. Additionally, the absence of spectral analysis for convective sources and wave propagation conditions relative to the mean flow leaves the study incomplete. Consequently, I cannot recommend the manuscript for publication in ACP in its current form. Detailed comments for improvement are provided below.

Specific Comments:

1. Insufficient Literature Review and Theoretical Framework

- The manuscript overlooks several key studies on TGWs. Source mechanisms and stratospheric TGWs have been extensively investigated using spectral analysis, which accounts for wave propagation from the cloud top to target altitudes under various background flows. The current analysis appears insufficient, likely due to a lack of familiarity with these established methodologies.
- One significant contribution of TGWs to typhoon dynamics is missing from the Introduction. TGWs generate divergence in the UTLS, leading to compensatory convergence at the typhoon center, which enhances typhoon intensity. This feedback loop is a crucial aspect of TGW research, and references investigated this subject should be included and discussed to provide proper context.
- Since TGWs are a subset of convective gravity waves (CGWs), characterizing them through source spectra and propagation conditions is essential for a comprehensive understanding of their behavior. Although the depth of the convective source and the level of maximum heating were discussed earlier (Figs. 8 and 9), their physical significance was not explicitly detailed. This relationship can be explained by the resonance between the natural modes of internal GWs defined by the dispersion relation and the vertical harmonics of the convective forcing. The reference investigated regarding this issue should be included and discussed to provide proper context.

2. Unbalanced Experimental Design

- Given that diabatic heating is the primary source of TGWs, sensitivity experiments should prioritize various CP and microphysics schemes over PBL schemes. I strongly recommend reducing the emphasis on PBL variations and instead expanding the range

of cloud microphysics and CP options. A comparison of Figures 4, 5, and 6 clearly indicates that the inclusion of a CP scheme produces large-scale features that are vital for TGW representation.
- In the current setup, the CP scheme experiment uses the WSM6 microphysics scheme instead of the Goddard scheme (Table 1), despite the latter generally showing superior performance. To ensure robustness, the authors should at least include an experiment combining Goddard and Grell-3.

3. Quantitative Analysis of TGWs

- The study relies on the standard deviation of vertical velocity to represent TGW activity. However, the dynamical importance of stratospheric TGWs lies in their momentum deposition upon dissipation. Without analyzing wave breaking and dissipation, wave activity alone does not provide a complete picture of their impact on large-scale flow. A standard frequency-wavenumber spectral analysis is required to determine which portions of the source spectrum are filtered out and which propagate into the middle atmosphere.
- The authors select TGWs based on a specific magnitude threshold. However, as noted above, large-amplitude waves can be less significant if they are filtered at lower altitudes. Conversely, smaller-amplitude TGWs that may survive in the upper level can deposit significant amount of momentum forcing when they dissipated there, due to the inverse relationship between density and drag. Therefore, the analysis should consider the full spectrum of amplitudes rather than focusing exclusively on the strongest waves.

4. Lack of Physical Interpretation

- The manuscript offers almost no physical reasoning for the differences observed between various schemes. Simply stating that results differ is not a scientifically meaningful contribution. Each parameterization is built on distinct theoretical or empirical foundations; the authors must discuss the simulation results in the context of these underlying physical differences to provide insight into *why* certain schemes perform differently.