General comment:

The revised manuscript has substantially improved compared to the former version. I believe that the science is in most parts well presented and that the general conclusions are convincing. Even though the language has improved, there are still numerous instances where the language or the writing is not sufficient and needs to be further improved. Only after this major editorial work is done, the paper is acceptable for publication in AC. Below I list most of the places that I found would need editorial work. I also include a few minor comments regarding the science.

Thank you very much for your good comments concerning our manuscript entitled “How do gravity waves triggered by a typhoon propagate from the troposphere to the upper atmosphere?”. Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We also thank you very much for your help in modifying the expression of English sentences. We have studied comments carefully and have made corrections which we hope meet with approval.

The detailed point-by-point responses are given below.

Minor comments:

L22: exponentially with height

Response：
Thank you very much for your suggestion.
"exponentially" is replaced by "exponentially with height” in the revised manuscript.
(Please see line 23 in the manuscript with track)

L25: mechanism of the [you do not show a mechanism that relates to typhoons in general: you mean a specific typhoon]

Response：
Thank you very much for your comment.
We re-described this sentence as: "We used ERA-5 reanalysis data and Multi-functional Transport Satellite-1R observations to quantitatively describe the propagation processes of typhoon-generated CGWs from the troposphere, through the stratosphere and mesosphere, to the thermosphere. " in the revised manuscript. (Please see line 25-28 in the manuscript with track)

L28: “like the relay” ???

Response:

“like the relay” is discarded from the revised manuscript. (Please see line 30 in the manuscript with track)

L32-38: This paragraph contains about a dozen typos.

Response:
Thank you very much for your comment. We re-described this paragraph as: " Gravity waves (GWs) can transfer momentum and energy from the lower to the upper atmosphere, thereby affecting global circulation and the thermal and compositional structures in the middle and upper atmospheres (Holton, 1983; Fritts and Alexander, 2003). Studies of dynamical, photochemical, and electrodynamics processes have indicated that GWs are fundamental for the coupling process between the troposphere, stratosphere, mesosphere, and thermosphere (Liu and Vadas, 2013; Smith et al., 2013; Vadas and Liu, 2013; Xu et al., 2015; Vadas and Becker, 2019)." in the revised manuscript. (Please see line 34-41 in the manuscript with track)

L39: of GWs and considered

Response：
"of GWs considered " is replaced by " of GWs and considered” in the revised manuscript.
(Please see line 42 in the manuscript with track)

L40-41: by GW breaking

Response：
" primary wave " is replaced by " GW” in the revised manuscript.
(Please see line 43-44 in the manuscript with track)

L56-59: This somewhat confusing. First, it has to be “wave-wave interaction” and “wave-mean flow interaction”. Second, wave-mean flow interaction is at the beginning of the mechanism for secondary GW generation discussed in the papers by Vadas and coauthors. Please reformulate accordingly.

Response：
Thank you very much for your comment.
We re-described this sentence as: "Moreover, wave-wave interaction, wave-mean flow interaction (Franke and Robinson, 1999; Vadas and Fritts, 2001), self-acceleration, and nonlinear breaking are other potential secondary wave generation mechanisms (Lund and Fritts, 2012; Fritts et al., 2015; Dong et al., 2020; Fritts et al., 2020; Zhou et al. 2002; Heale et al. 2020). " in the revised manuscript. (Please see line 62-66 in the manuscript with track)

L65: the lower to the upper atmosphere.

Response：
" the lower atmosphere to the upper atmosphere" is replaced by " the lower to the upper atmosphere" in the revised manuscript. (Please see line 70 in the manuscript with track)

L73-74: ".. was utilized to identify the mesosphere and thermosphere via ray tracing" – This does not make sense. Please reformulate.

Response：
Thank you very much for your comment.
We reformulate this sentence as:" However, given the observational limitations between the mesosphere and thermosphere, the two layers are connected by ray tracing theory. " in the revised manuscript.(Please see line 78-80 in the manuscript with track)

L74: to (a) investigate

Response：
"scrutinize" is changed to " investigate". (Please see line 82 in the manuscript with track)

L83-85 atmospheric waves in the middle and upper atmosphere triggered by severe events such as typhoons, earthquakes, and tsunamis.

Response：
We reformulate this sentence as:"The research aim of the DLAN is to explore the physical mechanism of vertical and horizontal propagation and the evolution of atmospheric waves in the middle and upper atmosphere triggered by severe disasters, such as typhoons, earthquakes, and tsunamis. " in the revised manuscript.(Please see line 90-93 in the manuscript with track)

L95-96: … an excellent opportunity for studying coupling processes between the mesosphere and thermosphere.

Response：
We reformulate this sentence as: "Furthermore, the DLAN provides an excellent solution for studying the coupling processes between the mesosphere and thermosphere." in the revised manuscript.(Please see line 104-106 in the manuscript with track)

L123-125: discard "which provides … layers"

Response：

As your suggestion, “which provides an excellent example for observing the CGWs stimulated by the typhoon and studying the coupling among the atmospheric layers" is discarded from the revised manuscript. (Please see line 134-135 in the manuscript with track)

L141: mention the cadence of the ERA-5 data

Response：
We reformulate this sentence as: "Horizontal reanalysis temperature and wind data with a pre-interpolated resolution of 0.25° × 0.25° and time resolution of 1 h were used in this study. " in the revised manuscript.(Please see line 151-152 in the manuscript with track)

L157: How is \omega related to \omega_{Ir} in Eq (1)?

Response：
$\omega_{Ir} = \omega_r - (ku + lv)$, where ω_{Ir} is the intrinsic frequency, ω_r is ground-based frequency. (Please see line 158 in the manuscript with track)

L168-169: We extracted the stratospheric CGW excited by the typhoon from ERA-5 reanalysis.

Response：
We reformulate this sentence as: "We extracted the stratospheric CGW excited by the typhoon from ERA-5 reanalysis" in the revised manuscript. (Please see line 185-186 in the manuscript with track)

L178-179: … temperature perturbation at 60 km in ERA-5 was only …

Response：
Thank you very much for your comment.
"altitude" is replaced by "in ERA-5" in the revised manuscript. (Please see line 196 in the manuscript with track)

L183-185: This citation of Liu et al. (2014) does not seem to fit perfectly well here. You want to cite a paper that shows that the larger-scale CGW arrive earlier at higher altitudes (have faster vertical group velocities) than the smaller-scale waves. This mechanism was discussed in detail by Vadas and Azeem (2021, JGR-SP), https://doi.org/10.1029/2020JA028275

Response：
Thank you very much for your comment and suggestion.

Reference Vadas and Azeem (2021) is appropriately cited here, while reference Liu et al. (2014) is moved to the Introduction section. (Please see line 206-208 and line 49-51 in the manuscript with track)

L207-208: This sounds very confusing. Perhaps the 3rd author can reformulate this?

Response：
We reformulate this sentence as:" As long as the CGWs do not encounter the critical layer or break, the CGWs generated in the lower atmosphere can propagate to the OH airglow layer." in the revised manuscript.(Please see line 228-230 in the manuscript with track)

L209-210: I do not understand: You see different predominant horizontal wavelengths at 20 and 40 km!

Response：
We reformulate this sentence as:"A single dominant horizontal wavelength is seen at each altitude of 20 km, 40 km, and 60 km in the ERA-5 reanalysis. " in the revised manuscript. (Please see line 231-232 in the manuscript with track)

L211: “due to the limited resolution” – what is the context here??? Note that the 150 and 300 km wavelengths that you find are very well resolved by ERA-5.

Response:
“due to the limited resolution” is discarded from the revised manuscript.
(Please see line 232-233 in the manuscript with track)

213: discard “as the imager … resolution”. I have no idea why and how you want to relate the resolution of the imager to the resolution of ERA-5.

Response:
“as the imager has much higher spatial resolution” is discarded from the revised manuscript.
(Please see line 234-235 in the manuscript with track)

L215-216: very confusing formulation. Third author, please step in. What is a “phase plane”???

Response:
We are very sorry to confuse you. We realized that this description was inaccurate, so we reformulate this sentence as:"To verify whether the same wave was propagated from the reanalysis data layer to the OH layer, we used the group velocity to estimate the time when the

CGW at the altitudes of 20 km, 40 km, and 60 km reached the OH airglow layer. " in the revised manuscript. (Please see line 237-240 in the manuscript with track)

L220-222: Therefore, the times when the CGWs visible in ERA-5 at 60 km, 40 km, and 20 km would reach the OH airglow layer are approximately …LT, …. LT, and … LT, …

Response：
We reformulate this sentence as:"Therefore, the times when the CGWs visible in ERA-5 at 60 km, 40 km, and 20 km would reach the OH airglow layer are approximately 23:21 LT, 23:36 LT, and 23:53 LT as shown in Fig. 5a, 5b, and 5c, respectively. " in the revised manuscript. (Please see line 242-245 in the manuscript with track)

L229-231: … tracked over different altitudes and that the CGWs in the mesosphere propagated upward from the stratosphere. [You did not show in this paper that the GWs you see in ERA-5 were excited by the typhoon. This is just a reasonable assumption that you made.]

Response：
Thank you very much for your comment. We reformulate this sentence as:" This suggests that the same CGW event can be perfectly tracked over different altitudes and that the CGWs in the mesosphere propagated upward from the stratosphere." in the revised manuscript. (Please see line 252-255 in the manuscript with track)

L242: “The observation period” ??? Do you mean “observed wave period” ?

Response：
Yes, you are right.
"observation period" is changed to "observed wave period". (Please see line 266 in the manuscript with track)

L243: why “multi-scale”? You are discussing predominant wave parameters, or not?

Response：
Thank you very much for your comment.
“multi-scale” is discarded from the revised manuscript. (Please see line 268 in the manuscript with track)

L246: “faster phase speed and shorter period” than what?

Response：
Thank you very much for your comment. We reformulate this sentence as:" The CGW observed in the OI 630.0 nm airglow had much faster phase speed and shorter period than that observed

in the mesosphere " in the revised manuscript. (Please see line 270-271 in the manuscript with track)

L248-250: “Indeed … km.” – This sentence is hard to understand. Please reformulate.

Response：
Thank you very much for your comment. We reformulate this sentence as:" Indeed, compared with the long-distance extension of the CGWs in the mesosphere, the horizontal propagation distance of the CGWs in the thermosphere was only 600 km from OI 630.0 nm network observation." in the revised manuscript. (Please see line 273-276 in the manuscript with track)

L250-252: Vadas and Crowley (2010) showed that thermospheric GWs may be secondary GWs generated by the breaking of primary GWs in the mesosphere and thermosphere.

Response：
Thank you very much for your comment. We reformulate this sentence as:"Vadas and Crowley (2010) showed that thermospheric GWs may be secondary GWs generated by the breaking of primary GWs in the mesosphere and thermosphere. " in the revised manuscript. (Please see line 278-280 in the manuscript with track)

L252-253: “We argue …. Pattern.” – This is sentence does not make sense.

Response：
Thank you very much for your comment. We reformulate this sentence as:"We argue that the thermospheric CGW observed by the OI 630.0 nm airglow imager was not directly generated by the typhoon, but a secondary GW. " in the revised manuscript. (Please see line 280-283 in the manuscript with track)

L269: We started the ray-tracing at heights of 240 km, 250 km, and 260 km , and analyzed the results.

Response：
Thank you very much for your comment. We reformulate this sentence as:" We started the ray-tracing at heights of 240 km, 250 km, and 260 km , and analyzed the results. " in the revised manuscript. (Please see line 296-298 in the manuscript with track)

L274: that a reflection layer was encountered. According to linear theory, this suggests that …

Response：

Thank you very much for your comment. We reformulate this sentence as:"Subsequently, seven backward traced trajectories took 37 minutes and terminated at an altitude of approximately 95 km thereby indicating that a reflection layer was encountered. According to linear theory, this suggests that the thermospheric CGW could not have come from below 95 km. " in the revised manuscript. (Please see line 301-305 in the manuscript with track)

L275: … 95 km. Therefore, the thermospheric GWs must have …

Response：
Thank you very much for your comment. We reformulate this sentence as:"The thermospheric GW must have been generated at any altitude between 95 km and the altitude of the OI 630.0 nm airglow. " in the revised manuscript. (Please see line 305-306 in the manuscript with track)

L278: … 00:23 LT. Figure 9 …

Response：
“Meanwhile,” is discarded from the revised manuscript. (Please see line 308 in the manuscript with track)

L286-287: Please discard “which showing clear signs … processes”! Also note that you mention here the same conclusions that you already stated 12 lines earlier.

Response：
Thank you very much for your suggestion.
“, which showing clear signs of dissipation and/or nonlinear processes” is discarded from the revised manuscript. (Please see line 316 in the manuscript with track)

L291-305: These arguments are not conclusive. My understanding is that the reason for the difference between center of the fitting circle and the end points of the ray racing is not the fact that there are some large horizontal background winds. Rather, the background winds you used in the ray tracing model were presumably not realistic enough. This would be plausible because the HWM model is an empirical model. Another possible mechanism is that the wave phase speeds are accelerated by accelerating background winds. Does your ray tracing model include this transient effect (time derivatives of the background wind components giving rise to time derivative of the frequency for a particular ray)? You should include the answer to this question in your Sec. 2.4.

Response：

We appreciate your constructive suggestions, which are very beneficial for improving our paper. According to your suggestion, the following discussions are added to the revised manuscript.

"In this study, we assume that the background wind field is independent of time, so ground-based frequency ω_r remains constant along a ray's path (Lighthill, 1978). However, the actual wind field changes with time, which may lead to deviation between the ray tracing results and the wave source locations." (Please see line 171-175 in the manuscript with track)

"Another possible mechanism is that the wave phase speeds are accelerated by accelerating background winds. As mentioned above, the ground-based frequency ω_r remains constant along a ray's path assuming the background wind field is independent of time (Lighthill, 1978). However, transient effect (time derivatives of the background wind components giving rise to time derivative of the frequency for a particular ray) may cause the phase speeds to be accelerated, which may lead to the ray-tracing results did not match the real locations." (Please see line 333-339 in the manuscript with track)

L331-332: This sentence cannot relate to what has been shown in this paper up until here. Please discard this sentence and start the paragraph with "Figure 11 shows ..".

Response：
Thank you very much for your suggestion.
"We elucidated the dissipation process of the CGWs in detail by examining the evolution process of their amplitude." is discarded from the revised manuscript. (Please see line 368-369 in the manuscript with track)

L333: Which wave fronts???

Response：
"wavefronts" is replaced by "wavefronts (w1-w5)". (Please see line 370 in the manuscript with track)

L33-334: "A dominant … confirmed." – Sorry, this cannot be concluded based on Fig. 11. Please reformulate.

Response：
We are very sorry for not showing it clearly. We have re marked it in the Fig. 11. Please check.

L334: "As a result" ??? What logical connection do you have in mind here?

Response：
"As a result" is discarded from the revised manuscript.
(Please see line 371 in the manuscript with track)

L343-346: Sorry, but I cannot follow these formulations. Please reformulate.

Response：
Thank you very much for your comment. We reformulate this sentence as:" We obtained similar scale fluctuations were obtained in the two airglow layers. The horizontal wavelength of the wave obtained by the OI 630 nm airglow layer was approximately 118 km. The OH airglow layer has also obtained near-scale fluctuations with wavelengths of approximately 109 km. These waves could be the same waves seen in the thermosphere. " in the revised manuscript. (Please see line 380-384 in the manuscript with track)

L357: Note that wave amplitude fluctuations can …

Response：
We reformulate this sentence as:"Note that wave amplitude fluctuations can also result from the transient nature of the wavepacket. " in the revised manuscript. (Please see line 395-396 in the manuscript with track)

L358-360: Please reformulate!

Response：
We reformulate this sentence as:" The propagation state can be studied by using the dispersion relationship with GW. However, the dissipation region of the CGW lacks the real-time background temperature and wind field." in the revised manuscript. (Please see line 396-398 in the manuscript with track)

L360: TIMES/SABER etc. appears out of the blue. Please reformulate and provide the context.

Response：
"TIMES/SABER" is changed to "the limb-viewing of Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument on the Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) satellite". (Please see line 398-401 in the manuscript with track)

L361-362: “On this basis” ??? What is the logic here?

Response：
We reformulate this sentence as:" Background wind field data were obtained from an ATRAD MDR6 all-sky VHF meteor radar at Beijing station. " in the revised manuscript. (Please see line 402-405 in the manuscript with track)

L366: “sound”???

Response：
“sound” is changed to " measurement location ". (Please see line 408 in the manuscript with track)

Figure 13, caption: Which color is what?

Response：
We reformulate the caption as below:

Figure 13. Vertical wave number m^2 profile (black) derived from the temperature from TIMED/SABER measurement location at 04:18:49 LT and the meteor radar wind from Beijing station marked in Fig. 9. The red line represents the OH1.6 μm emission intensity obtained by the TIMED/SABER. The horizontal blue lines represent the top and bottom boundaries of the duct region.
(Please see the caption of Fig. 13 in the manuscript with track)

L402-403: … to connect GWs in the upper mesosphere to GWs in the thermosphere at about 250.

Response：
We reformulate this sentence as:" Due to the observational limitations, a backward ray-tracing theory was used to connect GWs in the upper mesosphere to GWs in the thermosphere at about 250 km." in the revised manuscript. (Please see line 445-447 in the manuscript with track)

L404-405: The fact that your rays terminated in the upper mesosphere does NOT imply “clear signs of primary GW dissipation and/or nonlinear processes”. Please discard this phrase.

Response：
Thank you very much for your suggestion.
“, which shows clear signs of primary CGW dissipation and/or nonlinear processes” is discarded from the revised manuscript. (Please see line 448-449 in the manuscript with track)

L406: the OH network

Response：
" OH network " is replaced by " the OH network” in the revised manuscript.
(Please see line 450 in the manuscript with track)