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Comment on angeo-2022-24

Anonymous Referee #1

Referee comment on "Effects of the super-powerful tropospheric western Pacific phenomenon of September–October 2018 on the ionosphere over China: results from oblique sounding" by Leonid F. Chernogor et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2022-24-RC1, 2022

Review report on the Manuscript: "Ionospheric Effects over the People's Republic of China from the Super-Powerful Tropospheric Western Pacific Phenomenon of September–October 2018: Results from Oblique Sounding"

(A) General Comments :

The authors deserve merit for putting up efforts in analyzing and presenting Doppler spectra of the signals recorded over eight propagation paths for identifying typhoon-induced effects at the ionospheric height, a subject of importance in understanding lower-upper atmosphere coupling dynamics. The prime data in the analyses are oblique incidence signal reception quality in the frequency range 6.015 MHz – 9.75 MHz at Hibon China from the transmitters located in Japan, South Korea, and China.

However, the work requires clarification on some vital issues and needs supporting parameters to justify the final conclusion of the work which goes as "the periodic components of 20 min to 120 min at the ionospheric heights as reflected in the received signals are the effects of the superpowerful typhoon of September – October 2018". The authors need to provide the required inputs and clarifications for assessing the fulfillment of the aims of the work and to judge the scientific merit of the paper.

The paper thus requires major revision to make it suitable for publication in the esteemed Journal. A few suggestions and recommendations are put forward for possible implementation in the revised MS :

(i) Going through the Doppler spectra (Figure Nos. 6 to 13) presented separately for the

different paths covering the period from September 29 to October 6, it is, however, observed that as claimed in the MS the components within 20 mins to 120 mins, are not visible (except the latter component in some cases) and apparently indistinguishable. These components must be well displayed along with their respective power because these are the basic parameters leading to the conclusion of the work. The results of observations also need to be coherent and clear which are somewhat missing and thus difficult to keep track of the records imprinted by the Typhoon (if any) on different propagation paths, to make a constructive comment.

(ii) To strengthen the conclusion, it is also recommended that Doppler spectra for the period not influenced by the Typhoon may be presented along with the observations from September 29 to October 6, which cover the growth and landfall days of the typhoon.

(iii) Further, to establish the growth of such periodic structures at the ionospheric height by the typhoon-induced wave -dynamics at the lower atmosphere, supporting evidence is necessary. It is thus suggested that the authors present profiles of any lower atmospheric/near-earth parameter during the period and around the locations covered by the study, to identify the features present therein with the wave components provided by their Doppler analysis.

(iv)The authors no doubt have tried to associate density fluctuation (ionosphere) with the formation of waves but need justification for their approach as the considered paths are of varied propagation statuses and positions. It is important also to provide physics and system dynamics associated with density modulations leading to the formation of waves. The scientific explanation is missing.

(v)The abstract, the basic key to the contents of the paper is not well spelled out and needs to be rewritten with clear objectives and approaches.

(vi) Discussions and Conclusions are to be modified accordingly.

(vii) There are scopes for improvement in sentence construction and also in clarity.

(B) Other comments :

(i) Line number 20 -25:The authors' statement that “typhoon-induced effects are clear near the midpoint of communication path”.

This needs clarification when several propagation paths covering SE, S, and NW directions are taken for their study and the mid-point of one propagation path varies from the other. From Figure 1(a) and Figure 5 one can see that the Typhoon trajectory and mid-point of the communication link may come nearer only from October 4 that too in the Harbin –Yomotta, Harbin- Chiba, Harbin-Goyang and Harbin-Hwasenong paths. These points may be cleared and looked into while explaining their observational results.

(ii) Concerning (i) above, it is observed that wave components of 20 mins to 120 mins as claimed as Typhoon–induced effects are not visible, except for the Chiba-Herban link Doppler spectra which provide relatively clear components of 2/3 hrs (Figure 7). But those signatures appeared even on September 29 -30, and also on October 6 (also identified by the authors). It is not understood why on September 29 relatively clean wave structure is seen (Figure 7) when it was in a tropical storm category and only on September 30, the storm attained Typhoon status. Further, the Kong Rey then weakened to category 3 on October 3 and degraded to a tropical storm on October 4, and made landfall on early October 6. Therefore it seems that the superpowerful typhoon effect may not be seen by the authors from October 4 as Kong-Rey penetrated the Chinese mainland, at 18:00hrs on October 3. The authors are suggested to look into their statement and discussion in this background and to provide Doppler spectra for days free from typhoons for clearing the issue.

(iii) As the observations are in the oblique mode, the tropospheric effect cannot be ignored, when the contribution varies with the looking angle of the signals from the transmitter. It is suggested that the authors analyze tropospheric/near surface parameters along the path of propagation (or around) and look for (if detected) supporting inputs to justify the authors' conclusion (already suggested above).

(iv) The Wakkanai ionogram may also be examined for such waves. The relevance of figures 3 and 4 are to be clearly spelled out and may be brought into the discussion while explaining the observed Spectral components. The only points of reference of these figures in the MS perhaps are in terms of diurnal variations in layer reflection height and critical frequency status during the period of study.

(C) Additional Comments :

(i) Caption of the MS :

The caption may be more appropriate as “Effects of Super-Powerful Tropospheric Western Pacific Phenomenon of September–October 2018 on ionosphere over china: Results from Oblique Sounding”.

(ii) Abstract :

The abstract is not well spelled out and needs to be rewritten with clear objectives and approaches. It is necessary to mention what ionospheric parameters the authors are monitoring, and of signal sources.

A few examples :

"The ionospheric response to the super typhoon action was clearly observed to occur both on October 1–2, 2018 (when the typhoon was 2,800–3,300 km from the propagation path midpoints .." (As already identified in other comments (i) above)

Similarly: " … on October 5–6, 2018 when the typhoon was 1,000–1,500 km from the midpoints and its energy decreased by a factor of about 4."

And also " The ionospheric effects are more pronounced along the nearest propagation paths, whereas no effect was detected along the propagation path at the farthest distance from the typhoon ".

These are vague and unspecified sentences carrying no meaning if not mentioned the receive mode and propagation paths of signals.

(iii) Introduction and Discussion :

In the introduction, the authors introduce relevant references on the need of understanding typhoon-induced effects by coupling dynamics between ocean-lower and upper atmosphere through gravity waves, water vapor condensation, and severe thunderstorms (to name a few).

The authors have not brought up these parameters and issues either in the analysis or in the discussion. The introduction and discussion aspects should bear relevance.

(iv) Figures :

Figure 2: Here Space weather knowledge is no doubt relevant. These plots however may be omitted and Kp, Dst magnitude statement may be enough to support the status of the days.

Figures 3 and 4: The relevance of the content of the figures to be placed in the MS where appropriate (already identified above).

Figure 4: Check for the y-axis

Virtual height E is to be replaced with Es.

(v) Clarity of sentence suggested (examples):

(a) Line 170: "…Main ray and few rays "

(b) Line 225-230:: " L 1.5 Hz, broadening±he Doppler spectra exhibit significant, up to and such a diffuseness that the main ray is practically not distinguishable"

(vi) Reconstruction of sentence necessary (examples)

(a) Line No 320: "The frequency of this radio wave became greater than the maximum usable frequency and the radio wave penetrated the ionosphere during the second half of the nights. Consequently, the observation of became impossible".

(b) line No 325: "During the night of September 30, 2018, the reflection of radio waves took place from the sporadic E layer, resulting in fD(t) » 0 Hz. During October 1, 2018,

nighttime, the Doppler shift fD(t) » 0 Hz) as well. During the course of the October 2. 2018, night, the Doppler shift was observed to change from –0.3 Hz to 0.3 Hz, the signal amplitude was observed to exhibit considerable variability, up to 20 dBV, In the course of the October 3–6, 2018 nights, the measurements were ineffective, whereas fD(t) » 0 Hz at daytime."

Note also the highlighted segments.

Final Comment :

The paper needs major revision in light of the above suggestions and comments, before being considered suitable for publication.

Please also note the supplement to this comment:
https://angeo.copernicus.org/preprints/angeo-2022-24/angeo-2022-24-RC1-supplement.pdf