

Comments on, “**Signature of gravity wave propagations from the Troposphere to Ionosphere**” by Takahashi et al.

Using an airglow imaging observation, the authors observed gravity waves (GWs) in the mesosphere and MSTIDs in the thermosphere 4 hours later. Concurrent with the MSTIDs in the airglow images, concentric waves were also observed in the GPS detrended TEC. Furthermore, using the raytracing technique, source and dissipation region of the GWs is identified. From the obtained results, they argue that the source and dissipation region of the GWs are troposphere and lower thermosphere, respectively. The authors also postulate that the concentric wave could be a secondary wave caused by the breaking of the primary waves in the lower thermosphere. The objective of the manuscript is interesting, however, the results and discussion are not convincing. Though they have the seed but it is not enough to publish in the present form. For example, the authors mentioned that there is a MSTIDs in the 630 nm images and concentric waves in the dTEC but it is not clear in the Figures 3 and 4. I believe that in the dTEC, the western part bright patches are due to equatorial plasma bubbles (EPB) not due to the concentric waves, if the authors remove the artificial circles from the map we cannot see any concentric waves. Similarly, I could see 4 wave fronts in the OH images but the authors emphasizes only two, why? It is better to attach the movies of the images as a supplementary document or provide more images (dTEC maps) to show the evolution of the waves and MSTIDs. Therefore, I recommend to the editor for a major revision. The line by line comments are as follows:

Major comments:

1. In addition to the actual images, include the residual images to represent the waves and MSTIDs in a better way. Similarly, instead of showing only one or two images, the authors should show few more images in Figures 1, 3, and 4. Otherwise, it is hard to believe the existence of waves exist in the images? Particularly, in figures 3 and 4, I could not see the MSTIDs and concentric waves. Additionally, include the movies of the images and dTEC maps for this night in the supporting information.
2. Considering the number of the wave fronts (the area separation between them) and area of the OH images, I strongly believe that the horizontal wavelength of the GWs shown in this study does not exceed even 100 km. Check this carefully and comment on it. The residual images will represent the GWs and MSTIDs in a better way than the actual images.
3. By comparing the OI630 nm images and dTEC maps, one can understand that the red patches around the region of -45° to -60° longitude and -15° to 0° latitude is due to EPB. Moreover, if the authors remove the artificial circle, the concentric circle cannot be seen. The figure presented in the manuscript is not convincing. So, it is important to show the consecutive dTEC maps or the movie of dTEC maps.
4. Why the MSTIDs are not seen in the dTEC maps? Comment on it.
5. The red and blue bands in the keograms are most probably due to the EPB because the latitude considered for EW keogram is close to the equator, more importantly, the longitude (latitude in the NS keogram) where the bands are noted is exactly same where the EPB are observed in the airglow images. Justify this.

Minor comments:

6. From figures 1 and 2, one can see at least 4 clear wave fronts but why the authors emphasize only 2? In figure 2, NS keogram between 100- 200 km (~22-25 UT) there were four wave fronts but why it is not highlighted?
7. Line 130, how is the FFT analysis carried out?
8. Line 225 between 3-4 UT at least 4 data points should be available from the ionosonde observations, is the 220 km hourly mean value?
9. We could see the EPB in the images, during this condition how much reliable are the ionosonde hmF2 values?