

Ann. Geophys. Discuss., author comment AC1  
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## Reply on RC1

Hisao Takahashi et al.

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Author comment on "Signature of gravity wave propagations from the troposphere to ionosphere" by Hisao Takahashi et al., Ann. Geophys. Discuss.,  
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RC1: 'Comment on angeo-2022-13', Anonymous Referee #1, 14 Jun 2022 reply

(Please note that the text with **blue fonts** is Author's Reply and red fonts are a copy of the revised manuscript).

**Comments: This is interesting study which brings some new information but which requires some improvements before being published.**

*Concentric waves in dTEC are secondary GWs as I would expect. TEC is integral parameter; nevertheless the secondary GWs could hardly produce quite different wavy oscillations in TEC and in OI 630 nm emission from heights relatively close to the F-region maximum. Therefore possibility that the effect in OI 630 nm, which is essentially the same as the effect of primary waves in OH emission in the mesopause region, is caused by primary GWs unable to propagate well above the OI 630 nm height and affect TEC, seems to me to be probable.*

Reply: We thank for the Reviewer's comment that the effect in OI 630 nm is caused by primary GWs, and that of the dTEC are due to secondary waves. We understand in his (her) points of view. Since there is no definitive proves to conclude it, we discussed in the two possibilities, primary and secondary GWs. On the present stage, we prefer to summarize that there are two possible explanations.

*Section 2, Observations: I recommend add the analyzed period.*

Reply: Yes, the reviewer has a reason. We included the following sentences in the Section of "Observation"

(Line 75): In the present study we used the image data from December 2019 to September 2020. During this period, we selected 13 days to analyze wave structures in the OI 630 nm images.

*Line 173: the directions of propagation of GWs in OH and 630 nm emissions are relatively large, they cannot be considered to be almost same.*

Reply: We agree with the reviewer's comment. Regarding the direction of propagation, we included the following sentence:

(Line 197) The propagation directions of the two emissions, however, are slightly different, OH showing 149° against OI 630 being 113°, the difference of 36°.

And the difference of 36 deg is commented at the section of 4.3 Possible direct influence of primary wave in the ionosphere:

(Line 268) The difference of the propagation direction of 36° between the OH and OI 630 nm wave fronts could be due to the wind fields between the two emission altitudes.

*Wording and misprints:*

Line 44: "et al," should be "et al." Yes, corrected.

Line 50: "et al.," should be "et al." Yes, corrected.

Line 57: "generating" should be "generates." Yes, corrected.

*Line 61: "reach the mesosphere to the lower thermosphere". What do you mean, from troposphere to MLT or from mesosphere to the lower thermosphere (I expect the former).*

Reply: We agree with the reviewer's comment, and revised the sentence as follows:

(Line 62): It would take several hours to reach from the troposphere to the mesosphere-lower thermosphere (Vadas and Liu, 2013), which makes it difficult to follow the wave step by step.

Line 84: "one TEC" should be "one TECU"; similar corrections throughout the paper.

Reply: Yes, we revised "one TEC" to "one TECU".

Line 98: "an red" should be "a red": Yes, corrected.

Line 126: "could not observe" should be "could be observed": Yes, corrected.

Line 160: "region was" should be "region; it was": Yes, corrected.