Reply to the Reviewer 1

Manuscript #: angeo-2021-48

Title: A case study of a ducted gravity wave event over northern Germany using simultaneous airglow imaging and wind-field observations

Thank you for your explanations and clarifications. I am sorry that I could not reply earlier.

I am still having difficulties following your arguments. In your comments you write:

"We suggest that the ducting layer (85-91 km) observed in the present case (Figure 7c & e) was weak and so inhibited free propagation within that particular altitude region. Only part of the energy of the wave could penetrate through the bottom of the duct layer and the other part of the energy will be reflected back downward. Being localized, the part of the wave continued to propagate upwards into the O2 and O(1S) emission layer at higher altitudes (represented schematically in Figure 8). Since only a part of the wave energy could enter in the duct region (85-91 km), the wave structure was observed to be faint in the OH airglow images."

Please forgive me my ignorance. According to your above explanation, upon reaching the bottom of the wave duct, the wave packet splits into three parts: one part being reflected and propagating downward (this part does not show up in Fig. 8), another part being trapped inside the duct, and the remaining part continuing propagating upward. Inside the duct, the waves are guided towards north-east and eventually cross your observation volume. But how do upward propagating waves which are detected in the O(1S) and O2 bands get there? If they crossed the thermal duct in the south-west where the ducting was supposedly weaker, the waves would have to propagate at a very shallow angle (nearly horizontally) in order to reach the observation volume at 94 km altitude (O2 emission). Given the large vertical wavelength, this doesn't seem to be likely. The other possibility I can think of – waves crossing the thermal duct within the observation volume – is not likely either, because these waves should show up in the OH band with approximately the same intensity as in the O(1S) band. Is there any obvious piece of information that I am missing?

Based on the data at hand there may not be a fully convincing explanation. But in the interest of scholarship you may want to acknowledge any inconsistencies in the explanation presented in the manuscript. In particular, the depiction of waves in Fig. 8 is misleading. I don't think waves can be refracted around the duct layer in this way.

Reply: We thank the reviewer for the appreciation and comments. We have removed Figure 8 in order to avoid any confusion. Based on the reviewer's suggestion, we have also included a paragraph discussing the limitation of this paper (Page 12, line 368-377). We hope that the reviewer will appreciate our effort.