Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-121-RC2, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne measurements and large-eddy simulations of small-scale Gravity Waves at the tropopause inversion layer over Scandinavia" *by* Sonja Gisinger et al.

Anonymous Referee #2

Received and published: 12 May 2020

Summary:

This article presents an interesting observed case of trapped mountain waves that suggests the importance of interfacial dynamics along a tropopause inversion layer (TIL). The observations are unique and make the article a valuable contribution from the observational analysis alone. The study is further enhanced by interesting sensitivity studies using a 2D model comparing the wave response in both boundary layer inversion and TIL scenarios. I strongly recommend that the analysis done for Figure 13 be expanded to include the TIL simulation (see below). But overall the simulations represent a compelling initial investigation into this mechanism not previously observed

in the UTLS. Although the simulations lead to further questions, I agree that further investigation is appropriately left to future studies. The article is generally well-written, although a few points that should be rewritten (particularly in the Introduction) are highlighted below.

Specific comments:

paragraph starting at line 30: what is the point of this paragraph? I think you are trying to give an overview of our understanding of gravity wave propagation from the troposphere to the upper atmosphere, but you include a lot of older work just to say that it's more complicated than basic theory. That is not a new finding. The sentence at line 41 starting "Fine scale structures. . ." is directly relevant to your work. But the rest of the paragraph can be condensed/cut.

If you choose to keep more of the background information, several sentences are awkwardly worded or confusing and should be fixed:

1. line 40: "This makes the wave spectrum (i.e. wavelengths) being determined by the vertical varying wind and stability and not by the topography spectrum which affects the relative amplitudes": confusing sentence. Do you mean: "In other words, the wave spectrum (i.e. wavelengths) and wave amplitudes are determined by the vertical varying wind and stability and not by the topography spectrum."

2. lines 44-46: These two sentences are awkwardly stated and I'm not sure why they're needed.

line 82: a "tight" discussion? What do you mean by "tight" in this context?

line 115: compensating

line 118: need to state what alpha represents

Figure 6: Interesting figure, but the caption was hard to follow. A few rewrite suggestions: "Black contour lines mark regions significant at the 95%-confidence level. The

cone of influence is shaded in grey. Flight legs located below the tropopause (see labelled mean flight altitudes) are marked with grey background colour."

-also Figure 6: Is the black dashed line showing the thermal tropopause location?

line 238: "and a free slip lower boundary condition is used."

line 247: "The signal downstream of the terrain is"

Figure 13: This is a compelling figure for the boundary layer inversion (RUN 2) interfacial wave analysis, but why is this same analysis not shown for the TIL (RUN 4)? An additional panel would strengthen your argument.

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