

Interactive comment on “Lagrangian Gravity Wave spectra in the lower stratosphere of current (re)analyses” by Aurélien Podglajen et al.

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Reply to reviewer 2

We thank reviewer 2 for their evaluation of our paper and the constructive comments. Their suggestions for improvement have been taken into account. Please find below our point by point reply.

1. **Reviewer** — The authors use balloon data to assess the gravity wave spectrum in various reanalyses and one operational analysis. Although they find that that reanalyses represent the shape of the spectrum well, the variability is lacking compared to the balloons especially at higher intrinsic frequencies. Models with higher horizontal and vertical resolution represent the gravity wave variability bet-

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ter, although vertical resolution seems to have less of an effect than might be expected. They also show that including the balloon observations in the reanalyses improves the representation of gravity wave variance at low frequencies.

This paper is very well written and clearly organized. The results are very relevant and of great interest to modelers. These results will help give guidance to modelers trying to improve the representation of gravity waves in their models, both explicit and parameterized waves. I recommend this paper be published with a few minor considerations below.

Authors — Thank you

2. **Reviewer** — "Furthermore, due to their expected small horizontal scale the importance of non hydrostatic effects..." Should there be an "and" in here? Otherwise this sentence doesn't really make sense to me.

Authors — Yes, thank you. This has been corrected.

3. **Reviewer** — p.10, line 19: According to this equation, $R(\omega)$ should go to 0 as ω approaches f , but the Figure shows $R(\omega)$ goes to infinity as ω approaches f .

Authors — Actually, there was a sign error in the figures: the black line was depicting $|f| = -f$ (since Vorcore flew in in the Southern hemisphere) instead of f . Thank you for pointing this out, it is now corrected. We also specifically warn the reader about the sign of f below the formula.

4. **Reviewer** — p. 12, line 21: I would say "The latter behavior. . ." instead of "This last behavior. . ."

Authors — Changed as suggested.

5. **Reviewer** — p. 15, line 29: I would say "... , it is more prevalent at the lowest intrinsic frequencies..." also, pronounced would be a better word than prevalent.

Authors — Changed as suggested.

6. **Reviewer** — p. 15, lines 29-34: What about the influence of vertical resolution on this plot? In particular it seems like there is a clear distinction between the higher vertical resolution models and lower vertical resolution models in the u'w' columns for both pole and tropics.

Authors — Not exactly, since ERA5 has a higher vertical resolution than ECMWF(see Table 2). This point is now mentioned in the manuscript.

7. **Reviewer** — p. 15, line 30: This sentence doesn't really make sense grammatically: "Indeed, while Ekh than for variables with variance primarily contained at large w." I suggest maybe "Indeed, the dependency on horizontal resolution is more pronounced for Ekh than for variables with variance primarily at large w."

Authors — Changed as suggested

8. **Reviewer** — p. 16, lines 6-14: What about adding the truncated ERA5 to Figure 8? Would this provide more clues to the importance of horizontal vs vertical resolution?

Authors — Comparing the degraded ERA5 to the full ERA5 only provides us with a lower boundary for the dependence on horizontal resolution. Indeed, although it filters out small-scale waves, the low-resolution ERA5 has the same (high-resolution) sources of large-scale waves as the full ERA5, so that it still contains "information" provided by the high horizontal resolution for that part of the spectrum. Because of that, ERA5-lr should not be considered a high vertical resolution ERA interim, and the difference between ERAi, ERA5-lr and ERA5 cannot be solely attributed to either horizontal or vertical resolution. We now explain this point in more details in the manuscript.

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9. **Reviewer** — p. 16, line 10: broken off sentence: ". . . arise from the different propagation properties and ."

Authors — Missing "Sources". This has been corrected.

10. **Reviewer** — p. 25, Figure 4: The labels are quite tiny.

Authors — We agree. They have been enlarged.

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