

## ***Interactive comment on “Derivation of horizontal and vertical wavelengths using a scanning OH(3-1) airglow spectrometer” by Sabine Wüst et al.***

### **Anonymous Referee #3**

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We would like to thank the anonymous referee for his valuable comments. We included all of them. Please find our comments below.

Due to the comments of all three reviewers, I made the following general changes in the manuscript:

- The calculation of the vertical wavelengths from SABER data was limited to one wavelength for each profile in the range of the vertical wavelength derived from GRIPS +/- the error. As I re-calculated the approximation for the height range 70–90 km (instead of 60–80 km) for comparison reasons, I found out that the original approach might deliver not the best results. The SABER profiles show two to three waves. If I restrict the adaption to one more or less specific oscillation, which might not be the dominant one, the harmonic analysis provides a kind of compromise between both waves. Therefore, I provided less restrictions to the harmonic analysis: it searched for two oscillations with a wavelengths between 2.5 km (minimal vertical wavelengths detectable in SABER measurements according to Trinh et al., 2015) and 20

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- km (height interval length) and I used the one which fits better to the GRIPS vertical wavelength. Applying this approach, the difference between the vertical wavelengths derived from both approaches halves.
- When adding additional information to former table 2, I found out, that I included one wave with a rather long wavelength (33 km) in the subsequent analysis. This is not consistent with the exclusion of waves with vertical wavelengths longer than 20 km. Therefore, I corrected it.
  - I used the Brunt-Vaisala frequency calculated directly from the SABER profiles

These leads to different figures compared to the previous version. However, the main message of the paper does not change.

This paper derives spatial information on gravity waves near the menopause using airglow observations made at locations made at widely spaced positions in the horizontal. Using wind measurements made with a meteor-wind radar it is possible to convert the ground-based frequencies of the waves observed with airglow to intrinsic frequencies (frequencies measured in a coordinate system moving with the background wind) to infer important quantities such as GW vertical wavelength, that otherwise cannot be made with conventional single optical wavelength airglow observations. Results are compared with estimates based on TIMED-SABER data acquired on near-time overpasses. It is good to see comprehensive error estimates.

The paper is reasonably well written, although many sentences are convoluted. The paper would benefit from strong editing to improve readability and impact. Overall, the results are relatively unique and merit publication in AMT, subject to improvements in language and clarification of some issues that are unclear.

When talking about wave periods or frequencies it should be made clear whether these are ground-based or intrinsic e.g. Abstracts, line 17 add “ground-based” before “periods”. **Done, I also added this information in section 3.1**

2. P2, L2, “is studied using” is better grammatically than “is addressed by” **Done**
3. P2, L9, The sentence starting “A sufficient number ...” does not make sense and needs rewriting. **Done**

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4. L12, delete “under”. **Done**

5. L16, delete “like they” **Done but inserted “and” before “cannot”**

6. L29, “intrinsic frequency” not defined. Define here rather than later in the paper. **Done**

7. P4, section 21. The discussion of the FoV of the instrument is confusing. It is stated that the FoV triangle has an edge length of 90 km, but then it is stated that the FoV sizes are approximately 880 km. In what direction? If the field of view is 880 km x 880 km doesn't this average out all the detail in wave field? Schmidt et al (2013) claims that the GRIPS instrument has a FoV at 90 km equivalent to just a few km, which seems more reasonable. Please clarify.

I changed the formulation to “The edge length of the FoV triangle amounts to 90 km. Due to the finite aperture of the GRIPS 14, each FoV covers approximately 880 km<sup>2</sup> excluding the one in the zenith direction. The latter is smaller with ca. 560 km<sup>2</sup> (see fig. 1).” and added a sketch to make it clearer.

8. L9, add “the” before “zenith”. **Done**

9. P5, the tense of “data’ is confusing - singular in L4, plural in L6. Plural is better. **Done**

10. P7, L19, “insert “the” before literature and move “not” from before “exceed” to after “do”. **Done**

11. L22, delete superfluous “steps”. **Done**

12. P8, L4, insert “density” before “scale height”. **Done**

13. L6, the order of “medium and low-frequency waves” should be reversed to correspond to the order of the bracketed definitions. i.e. low- and medium frequency waves ( $\sigma \sim f \dots$ ) **Done**

14. Why not use the SABER temperature data to derive N? This will be more accurate than using outdated monthly mean CIRA-86 temperature profiles. **Done. I also inserted in section 3.2 why we still use a relative uncertainty of 10%.**

15. P10, L18. The sentence starting :Depending on ..” is confusing and needs re-writing. **Done**

16. L29, “twice” rather than “two times” [Done](#)

17. Table 2, is T the ground-based or intrinsic period? Define. [It's ground-based and I added this information](#)

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