

***Interactive comment on* “Observation of Kelvin-Helmholtz Instabilities and gravity waves in the summer mesopause above Andenes in Northern Norway” by Gunter Stober et al.**

Gunter Stober et al.

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General Reply to Reviewer #1: The authors thank the reviewer for taking his time to provide the comments below. We are grateful for the additional recommended publications. We also want to apologize for the mistake in the figure labelling. The comments raised are answered comment by comment. Changes in the manuscript are highlighted by latexdiff.

Comment: The authors quote earlier MST observations in the troposphere and mesosphere. It should be included that the SOUSY radar observed KH events in the mesosphere three decades ago (Reid et al, Nature, 1987). Reply: We thank the reviewer for

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pointing at the publication of Reid et al. 1987.

Comment: The VVP method has been described already in 2013. Nevertheless, the identification of short period and short wavelength gravity waves is an achievement with the MST radar. Reply: Compared to the publication in 2013 we improved the previous VVP methodology by extracting the horizontal information by a non-linear fitting routine to increase the degree of automatization.

Comment: The discussion is kept general, since no other simultaneous measurements are available. There are many other observations of KH in the mesosphere (e.g. air-glow, NLC), so it is not a new discovery. It is, however, the first report of KH from the MAARSY radar. Reply: Observations of KHI in the MLT are reported from different observational techniques. The analysis presented here on MAARSY observations are motivated to show that such small scale structures can be identified in the radial Doppler measurements using PMSE as tracer.

Comment: The comparison of the observed wave characteristics with the model results from Horinouchi et al (2002) seems only of limited usefulness, since they describe very different dynamical conditions. Reply: The simulations presented in Horinouchi are useful to bring a more general understanding on how instabilities can evolve for different sources. However, we agree that the dynamics describe in Horinouchi is different to what we can observe at polar latitudes.

Specific Comments

Comment: p. 3. Praise: It is appreciated to include detailed description of the outlier treatment. Reply: We modify this paragraph to make it better understandable on how meteors are removed. However, the presented numbers and thresholds depend on how the experiment is analyzed and also on the specifics of the radar. Other systems may require different removal strategies.

Comment: p. 5 l. 23. Why not use a local climatology of temperature (Lüben, Falling

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Spheres?) Reply: As shown in Luebken et al., 1999 there is a fairly acceptable agreement between the falling spheres and the MSIS-model.

Comment: p. 8. l. 29. I doubt that an old theoretical result (Lindzen 1988) can do justice to interpreting the observations compared to more modern simulations of GW breaking (e.g. Fritts, Hickey, Snively). The authors should try to compare with these more comprehensive models. Reply: The recommended papers are now discussed in the manuscript. The observed rather high phase speeds of the wave-like structures indeed indicates likely wave ducting as discussed in Snively.

Comment: p. 8 l. 5. For completeness, it would be good to include the relation for intrinsic and Doppler shifted quantities. Reply: We added both equations to the manuscript.

Comment: Technical Corrections AGAIN: All Figure references must be fixed! p. 6. l. 1. no red boxes p. 6 l. 6: $\lambda_h = 10.7$ km (horizontal) Fig. 10. Better use same y-scale for counts. Reply: Done.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-1170>, 2018.

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