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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Short vertical-wavelength inertia-gravity waves generated by a jet–front system at Arctic latitudes – VHF radar, radiosondes and numerical modelling" *by* A. Réchou et al.

Anonymous Referee #1

Received and published: 21 January 2014

RECOMMENDATION: minor revision

GENERAL COMMENTS

The paper reports on a field campaign devoted to gravity waves, which is interesting and worth publishing in ACP. They find from the joint analyses of radar, radiosonde and model data two wave packets above the tropopause. One of them has been described in the literature, the other is new. The discussion should be extended for some issues, the appendix could be taken out without loss of information, figures should be slightly

extended and quality-improved. After incorporation of these changes I think the paper is ready for publication and recommend: minor revisions.

SPECIFIC COMMENTS

1) REFERENCE: I suggest to include Zülicke & Peters (2008) into the references: they showed combined observations and modellings studies of jet-generated waves. They also include the Lagragian Rossby number as an indicator for potential wave-generation regions. Perhaps, it helps the interpretation of results with the model data.

2) PROPAGATION: The authors describe the wavepackets in the 10-to-14-km height region. In the discussion they should mention, that the wave packets are remaining there and do not propagate further up. If they are captured there (Bühler & McIntyre, 2005) or absorbed in a critical layer, remains to be discussed.

3) APPENDIX: For my taste this justification to study the Brunt-Vaisala frequency N is not neccessary. The authors describe what they have done, and that is sufficient. It is pretty technical information.

4) FIGURES: The figures should all re-processed. The axes are difficult to read, may be the DPI can be enhanced. Further below, some specific comments are added.

TECHNICAL CORRECTIONS

At many places in the text the authors refer to waves - perhaps they might abbreviate inertia-gravity waves with IGWs.

31252-19: "+" –> "+/-"

31253-2: "inertia gravity" –> "inertia-gravity"

31253-20: "ECkermann"

31253-10: Include here reference to Zülicke & Peters (2008) for study of jet-generated IGWs with 10 field campaigns and modelling at 54 N.

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31254-18: "and al." –> "et al."

31255-12: Include Zülicke & Peters (2008).

31255-21: Here, I guess you refer to horizontal wind speed - but I do not undertand why these should be small. I would expect the opposite due to the shallow inclination of the waves. However, this remark could also be taken out.

31255-23: "buoyancy-frequency" –> "buoyancy frequency"

31256-5: "spectral analysis (FOR observations"

31256-6: "analysis (FOR radiosonde"

31256-8: Perhaps, a linout-of-the-paper section can be given here.

31256-25: "N" has been defined before - should be used here.

31257-4: Please, specify value and unit of A.

31257-12: "this ISSUE can", but it need not (see above).

31257-14: "for THIS study"

31258-25: Please add an information on the used moisture scheme and orography.

31259-8: "westerly-north-westerly" –> "west-north-westerly"

31260-8: "cross sections" –> "cross-sections"

31260-9: "north westerly" –> "north-westerly"

31260-15: "waveS"

31260-20: "Leningrad" –> "St. Petersburg"

31260-22 delete "/wind"

31261-14: This forward-inclined wave packet is also not in Zülicke & Peters (2008).

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May be this is an effect of extraordinary strong upper-front activity?

31261-24: "waveS"

31263-1: "7.5 h, of" –> "7.5 h is of"

31264-9: Please, give here an information how the mean profile has been eliminated.

31264-29: "inertia gravity" –> "inertia-gravity"

31266-13: "Gaussian weighted" –> "Gaussian-weighted"

31267-14 (eq. 10): If you defined u' and v' in eq.s (8, 9) for the widn components, you should use the two compents of the momentum flux.

31267-17: The formula should read "(u'^2)_mean = |u'|^2/2", shouldn't it?

31267-18 (eq. 11): See two items above!

31268-6: "Ern et al." –> "They"

31268-21: "wave driven force" –> "wave-driven forces (also refered to as gravity wave drag)"

31268-25: "per day" –> "d^-1"

31268-27: "and the wavefronts distorted, by" –> "and distorted by"

31269-21: "short vertical wavelength" –> "short-vertical-wavelength"

31269-23: "2 day" –> "2-day"

31270-13: Here, a remark should be added that the waves in the present case do not propagate further up into the middle atmosphere. In other situations, with more wind, they well could.

31270-22: Include Zülicke & Peters (2008).

31271-11: Delete ", in the parameter which is to be used".

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31271-17: "signal power to noise power" –> "signal-to-noise ratio"

31272-12: Define "UTLS".

31273-2: I would insert a coma after "winds".

31273-6: I have my problem with "SNR > 0.5". Going into fig. A1, I wee for sigma_w = 0.1 m/s an SNR of 0.5, for 0.2 m/s 0.25 and for 0.3 m/s just 0.20 - or am I wrong.

31273-8: "that" –> "than". Further, a SNR information on Nˆ2 should be given: for 0.1 I take from fig. A1 a SNR of 0.2 - right?

31279 (fig. 1): Please, superimpose the radar mean wind in order to distinguish weak-wind and strong-wind periods as done for fig.s 5 and 6.

31280 (fig. 2): Please, add mean model wind.

31281 (fig. 3): Please, add wind (for intercomparison with fig.s 5 and 6).

31283 (fig. 5): Please, control the wind arrows for the cross-sections. Looking into the map, I would expect there arrows pointing to the left (into southerly directions).

31284 (fig. 6): See item above.

31288 (fig. A1): delete "all measured"

REFERENCES

Bühler, O. & M. E. McIntyre, 2005: Wave capture and wave-vortex duality. J. Fluid Mech. 534: 67 - 95.

Zülicke, C. & D. H. W. Peters, 2008: Parameterization of strong stratospheric inertia-gravity waves forced by poleward breaking Rossby waves. Mon. Wea. Rev. 136, 1: 98 - 119. doi:10.1175/2007MWR2060.1.

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