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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation of a mesospheric front in a dual duct over King George Island, Antarctica" *by* J. V. Bageston et al.

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General comments

The authors thank the referee for his comments and suggestions.

Comments and questions on Pg. C6928:

1) It is suggested that the wave likely propagated in a "dual duct". I agree with other reviewers that this term should be carefully defined to prevent confusion. But would the winds alone be strong enough to produce an effective Doppler duct?

REPLY: We agree with the referees regarding the usage of the term "dual duct", which could be misunderstood. Also, the winds alone are not strong enough to produce an

effective duct without the inclusion of the thermal contribution. Then, we change the term "dual duct" to "Thermal-Doppler duct", following the given suggestion.

2) ". . .A way to clarify this might be to include an additional profile in Figure 5a, calculating m2 using the observed winds but with N2 set constant. . ."

REPLY: We did the suggestion of the referee (see Figure 5 (a) and (c), dashed lines, by using N2 constant). We also include this profile in the discussions and comparison with the other profiles. Also, the Figure 5 of the paper was added at the end of this document(Figure 1).

Minor comments

3) Is it possible to adjust the contrast of the wave in the airglow images on Fig.1? This looks like a reasonably clear event, but it does not appear well when printed.

REPLY: Improvements in the images on Fig.1 were done (see Figure 1 in the answers to the referee R. Picard). Now the event is well seen also in the printed version.

4) In figure 5, "Backgroudn" should be changed to "Background".

REPLY: The word above was corrected.

5) Like the anonymous reviewer, I might be cautious calling this a "bore", since actual wave amplitude and structure hasn't been clearly determined. . .

REPLY: Now we believe that the wave structure is well defined, and its characteristics are consistent with a bore event, following the criteria given by Dewan and Picard (2001) [see details in the answer to the Anonymous referee, Question 1: Why is this Antarctic event a bore?].

Reference:

Dewan, E. and Picard, R.: On the origin of mesospheric bores. J. Geophys. Res., 106, 2921–2927, 2001.

5.1) Nevertheless, it is certainly a moderately strong ducted wave event that exhibits front-like character.

REPLY: Besides the above characteristic, the wave front was followed by trailing waves with growth in the number of wave crests.

6) One reference that might be of interest is Snively et al. [2007], where Doppler-ducting within a tidal wind field is considered for a front-like ducted wave event. In this case, Doppler ducting is alone sufficient to trap the wave, although it is still possible that a contributing thermal duct (via an inversion layer) may have existed at the time of observation:

Snively, J. B., V. P. Pasko, M. J. Taylor, and W. K. Hocking (2007), Doppler ducting of short-period gravity waves by midlatitude tidal wind structure, J. Geophys. Res., 112, A03304, doi:10.1029/2006JA011895.

REPLY: The suggested reference is being considered in the updated discussion of our results.

7) Another reference that might be of interest (but that is probably less relevant to the current paper) is Simkhada et al. [2009], where a study similar to Isler et al. [1997] was completed in conjunction with numerical modeling examples of waves in measured wind fields:

Simkhada, D. B., Snively, J. B., Taylor, M. J., and Franke, S. J.: Analysis and modeling of ducted and evanescent gravity waves observed in the Hawaiian airglow, Ann. Geophys., 27, 3213-3224, doi:10.5194/angeo-27-3213-2009, 2009.

REPLY: The above reference and also the reference of Smith et al. (2006) were considered in the updated version of this paper.

Other used reference:

Smith, S. M., J. Scheer, E. R. Reisin, J. Baumgardner, and M. Mendillo (2006), Char-

acterization of exceptionally strong mesospheric wave events using all-sky and zenith airglow observations, J. Geophys. Res., 111, A09309, doi:10.1029/2005JA011197.

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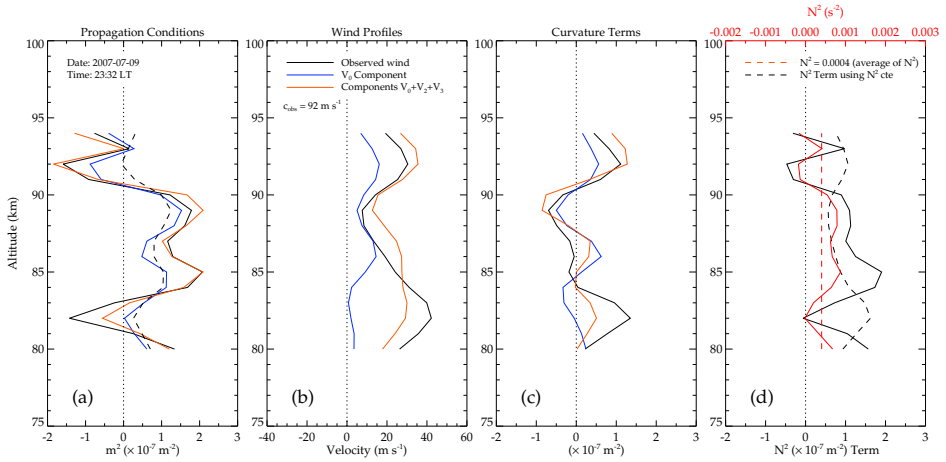

Fig. 1. (a) Profiles of mˆ2 for the different wind profiles shown in (b). (c) Curvature terms due to the winds in (b). (d) Nˆ2 (red, upper axis) and the buoyancy term (black, lower axis).