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Interactive comment on "Wind-profiler observations of gravity waves produced by convection at mid-latitudes" *by* Y. G. Choi et al.

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Reply to annonymous reviewers 1 comments By Adrian McDonald

This paper analyzes wind profiler observations to identify periods of active convection in the troposphere and their possible relation to gravity waves above the tropopause. Up to now, there are only a few observational study of this important topic. Therefore, the results will be of interest to the ACP readership. However, this ACPD version contains same weaknesses and leads to additional questions which should be addressed by the authors before the paper can be published in ACP, especially to receive more real conclusions in comparison to the present suggestions. In general, the title of the submitted paper "Wind-profiler observations of gravity waves" requires more knowledge of the waves or the title should

be changed to" detection of regions with enhanced convective activity".

We have changed the format of the work presented, such that a wider discussion of the evidence which suggests the observed waves in the tropospause are related to convective activity is detailed. See the first portion of Section 4 (page 7 to page 9). Thus, we do not believe it is necessary to change the title of the paper.

Major remarks:

Following Hooper et al., GRL, 32, 2005, the observations of large vertical velocity variability based on wind profiler observations are suggested to be associated with periods of strong convective activity. Here, it is proposed that the enhanced vertical velocity perturbations above the tropopause are associated with internal gravity waves generated by the convection. However, to get more insight in the gravity wave characteristics, the available horizontal winds as described in Sect. 2 have been only used here to estimate the variances of the mean zonal and meridional winds. Why the authors didn't make use of the 3D winds to investigate the gravity waves in more detail, following well-known methods e.g. described in previous "Aberystwyth" papers (Thomas et al, Ann. Geophys. 17, 115, 1999, and continuative articles of R. Worthington) or spectra of the zonal and meridional wind components as shown in cited paper of Vincent et al., 2004? The obtained conclusion, that it is "suggested that the large vertical velocity perturbations above the tro-popause are gravity waves" (Page 11044 in the submitted paper) will be much clearer if such information are included or at least discussed in more detail.

We disagree with the reviewers comments that the perturbations in the horizontal winds will make the paper considerably clearer. For two reasons both discussed in the text:

1, Previous studies suggest short period waves associated with convection are best observed in the vertical velocity field. The following lines have therefore been added :

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It should be noted that the vertical wind velocity field rather than in the horizontal wind components are used because a number of studies using a range of observational techniques have indicated that short-period convective gravity waves can best be analyzed in the vertical wind velocity field (Hauf, 1993; Hansen et al., 2002; Bohme et al., 2004). This result holds because the polarization relations (see Fritts and Alexander (2003) and references therein) indicate that the perturbations in the horizontal wind will be relatively small for short period waves.

2, Data quality is considerably better in the vertical data than the horizontal wind observations and thus the interpretation of the horizontal velocity data is probably more questionable in this case. The following lines have therefore been added:

It should be noted that the outliers present were generally observed in the horizontal velocity perturbations. The greater error in the horizontal component is associated to the fact that these values require Doppler shifts from the off-vertical beams in their determination and the signal to noise ratios observed in these beams is significantly poorer than those observed at the same altitude by the vertical beam.

Figure 1 shows a wind maximum at around 9.5 km associated with the edge of a jet which is located approximately 200 km to the south of Aberystwyth. Why the discussed gravity waves above the tropopause are associated with periods of strong convective activity? Why these waves are not induced by the mentioned jet?

As previously indicated the format of the paper has been changed and extra analysis has been performed to show that the short period waves observed are not associated with the jet region. See the first portion of Section 4 (page 7 to page 9). In particular the paragraph starting:

The vertical and horizontal group velocities of the gravity wave can then be calculated to be 2 and 10 ms^{-1} or 7.2 and 36 kmh^{-1}.

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on Page 8 should be examined.

Additionally to the used references, the authors should make use of the investigation of convectively forced short period gravity waves and their conclusions as recently published by Böhme et al., Q. J. R. Meteorol. Soc., 2004, 130, pp. 2933 - 2952. Their study is based on wind profiler data and includes very interesting discussions to understand these processes.

This was an excellent very relevant reference which we had not seen and are thus very pleased that the reviewer brought it to our attention. We have now referenced this work at relevant points in the text.

Some minor comments: Figure 3 and 4 representing time series of the vertical velocity, can be combined in one Figure.

The movement of different parts of the discussion in the paper required the movement of the description of Figure 4 to later in the paper and the relabeling of this figure to Figure 8. Thus, we now believe it is more relevant to have both these diagrams than in the previous draft and have thus kept both Figures.

There is no use of mathematical formulae, but their inclusion seem to be necessary to improve the readability of this paper, e.g. to explain how the confidence level in Figure 2 is defined, or to understand the sentence "The ratio of intrinsic frequency to buoyancy frequency determines the angle to the vertical at which the wave propagates" (page 11037)

This was an obvious flaw in the first draft which we have rectified by adding a section on Page 5 of the new draft. The reviewer is also referred to the first portion of Section 4 (page 7 to page 9). In particular the line on page 11037 identified has been removed and replaced with equation 1 in the new draft.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 11029, 2005.