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Atmospheric Measurement Techniques Discussions

Interactive comment on "The response of super pressure balloons to gravity wave motions" *by* R. A. Vincent and A. Hertzog

Anonymous Referee #2

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New data acquisition techniques on super pressure balloons (SPB) now allow to take measurements at a sampling rate of 30 seconds. This allows for the analysis of much shorter period GWs than hitherto possible. In consequence, SPB are now covering by far the widest range of the GW spectrum from all instruments which can give at least part-global coverage. As the current paper demonstrates they are probably also the most accurate measurement method. The current paper gives the fundamental technical description for the extended frequency range. It will therefore be the basis of many excellent work to come in the field of GW research and is highly recommended for publication in AMT. The paper is clear and well structured and only one specific point needs clarification. Also I have a few remarks to the introduction and some minor points the authors may want to consider for further improving the readibility.

Specific point:

The authors state in P812L13 that the horizontal propagation direction is "found with a 180 deg ambiguity". They later determine the vertical wavenumber. At P814L10 they state "Hence, the sign of m can be inferred from the balloon observables." As I understand the text, this resolves the 180deg ambiguity mentioned before. It will not allow to simulatneously allow for unambigiously determine the horizontal direction and the vertical propagation direction, i.e. a westward upward wave will still be undiscernable from an eastward downward wave. This point should be made more clearly in the text. As the authors state, it will still be possible to calculate net momentum fluxes which indeed is a very valuebale asset.

Introduction:

P799L11 With the aid of background wind velocities from global data assimilation systems one could, in principle, use the dispersion relation and Doppler shift to calculate the inrinsic frequency for any wave which is fully characterized (i.e. measuring three out of the four variables k,l,m,omega). However, SPB currently are the only technique which can fully characterize GWs and have at the same time part-global coverage measuring over land and ocean alike. They can hence determine GW momentum flux and its horizontal direction - a large advantage compared e.g. to current-day satellite measurements.

I think you should also strectch that SPB in the comparison of Alexander et al., 2010 together with IR limb sounders could cover the largest part of the spectrum of GWs. However, limitations towards short horizontal wavelengths are inherent in the method of IR limb sounders and limitations to short periods in the radio-sonde technique (at least considering omega and thus GWMF) but are only due to the sampling limitation for SPB, so since this was improved, SPB are now the only technique which can cover the complete range of waves with the potential to propagate from tropospheric sources into the middle atmosphere (cf. also Preusse et al., 2008).

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The paper of Boccara also was a technical paper, you should very briefly say in the introduction why a new technical paper is needed.

P800L8 That is rather an open question. These authors (and a quite large number of similar studies) investigate the GWs genearted by a single isolated convective tower. Accordingly they use high spatial resolution but at the price of a very limited model domain. As a result they find largest response at the shortest scales. Measurement evidence that these scales are really very important (or even dominant) in the momentum balance of the MA is extremely sparse. This makes SPB, which in future will provide a tropical climatology of all scales, extremly important. As much as I know you have now a paper on that topic accepted in JGR. Please refer to this, too.

P804L2 Figure 1 suggests ... Why? Because the first harmonic dominates? What exactly is related linearly to what? Please expand.

P805L9 using relationship Eq. (7), why use relationship?

P805L16 atmospheric conditions ?as? given in Sect. 3

P806L14 2 times that

P806L22 insert , after mathematical expression

Fig 3: In the text you use the terms Brunt-Vaissala frequency (period) and frequency of natural buoyancy oscillation of the balloon. Please be a bit more elaborate in the figure legend.

Equ. 24 imH use / non-use of italics ?

P815L11 where tau= 2pi/omega You have used this relation already plenty of times.

Figure 6: It became not clear from the text what you are actually using in this figure: u0 values at the threshold? For a range of paramters above the threshold? For Figure 6a,d even for fixed u0 the GWMF would vary with varying intrinsic period. Therefore a relative deviation between input and retrieved GWMF may be more helpful to see the

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actual error at least when considering the systematic deviations in 6a.

P818L12 Cf remarks to introduction

use of apparent: As a non-native speaker my first contact with apparently was along the line of seemingly. Using seeming and obvious which do not have this double meaning would apparently help to improve the readibility.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 10797, 2013.