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Atmospheric Measurement Techniques Discussions

Interactive comment on "On the distortions in calculated GW parameters during slanted atmospheric soundings" *by* Alejandro de la Torre et al.

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General comments

This is a novel and interesting study of an important aspect of GW parameters distortion due to slanted soundings. The distortion is theoretically derived and specific application is illustrated on GPS-RO and TIMED-SABER observations. Also, this is most probably the first paper that analyzes in details the distortion of GW parameters in relation to the wave front orientation and considering utilized instrument viewing-angle. The manuscript is generally well-written and should be published in AMT.

The paper brings a highly valuable remainder for the scientific community as it describes significant distortions introduced in the measured atmospheric gravity wavelengths by atmospheric soundings that are realized in other than in the vertical or horizontal directions. Resulting under or overestimation of real GW vertical and horizontal wavelengths is projected into calculated GW parameters or related spectral analysis. That may have significant consequences for comparison of GW parameters from different sources and general understanding of the parameters characteristics.

Specific comments

As for the specific comments, I have little to say as my previous comments were taken into account after the first review – the questions regarding saturated spectra and pseudo-momentum flux were answered (see below Reactions from the quick review), part regarding quantification of the distortion using a specific data was incorporated into the paper. I have only a suggestion for the discussion part connected to the quantification of the GW parameters distortion. Authors have already provided example of the quantification but it would be useful to elaborate this more also in the discussion to illustrate the implications and possible misrepresentation and distortion of our general understanding of GW parameters values, their (global) distribution, variability etc.

Technical corrections

p5/l123 - wavenumer
p7/l169-170 – approachs, dependance, cofusion, ariability
p9/l240 – erronrously
p15/l393 – overestimatons

Reactions from quick review

1) *In drawing their conclusions for potential energy of disturbances the authors should be cautious about the fact that for the possibility of Ep to be linked with the total wave energy (the reason why it is used in GW observations) it has to be computed from saturated spectra (e.g. VanZandt, 1985; Sacha et al., 2015). For saturated spectra, the dominant mode is naturally related to the largest vertical wavelength allowed for the analysis. What would be your conclusions if the GW ensemble (that you assume) would comprise ideally saturated spectra?*

Authors' response: As the reviewer states, from a measured spectra, the dominant mode is naturally related to the largest vertical wavelength allowed according to the selected vertical altitude interval. What we claim here is that any measured spectrum is obtained from a measured profile, and this will be unavoidably affected by the distortions above described due to the slanted nature of the sounding itself. Exceptionally, individual T vertical soundings as provided by lidar measurements, or from T, u, v or w, by radiosoundings under zero bakground wind conditions, will properly provide real GW spectra.

2) *In close relation with the spectral model you are using (5), it would also mean that all propagation directions are included. As you already mention in the text - e.g. the high aspect ratio expected in the Andes region due to a one dominant source of GW activity – the ideal spectra is far from the reach. But then the Ep should be used with caution already from the underlying theory. Note that your conclusions regarding the pseudo-momentum flux of Ern et al. (2004) should not be touched by this reviewer's concern as it is a conserved quantity.*

Authors' response: We agree that the peseudomomentum flux equation may be used as given by Ern et al, with the corresponding care discussed in the text in the calculation of the specific mean potential energy and considering the real vertical and horizontal wavelengths corresponding to the revailing GW mode. These wavelegths should be obtained after taking into consideration the expected distortions above described.

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