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Interactive comment on "Satellite Measurements of Stratospheric GravityWaves over the Andes/Drake Passage Region Using a 3D S-Transform Technique" *by* Corwin J. Wright et al.

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We thank the Reviewer for their very detailed review, which identified several areas where the text could be clarified. We respond to these individually below. We appreciate greatly the high level of detail of the review.

Minor Concerns

1. This has been altered to clarify our precise meaning.

2. This has been clarified.

3. The wrong reference was used, and has been replaced with the correct (Baldwin et al 2001) reference.

4. The statement has been modified to refer to preconditioning of the vortex.

5. Yes. This has been clarified.

6. We use both, and this is now stated in the text.

7. This is correct, and has been clarified.

8, 10. Our explanation on this matter was slightly unclear: the removal (and subsequent reapplication in Step 6) of exponential amplitude increase is done purely for signal processing reasons rather than as a geophysically-motivated step. This step is imposed because GW amplitudes at the top of the granule are typically several times larger than those at the bottom, leading to significant downward spectral leakage and making it difficult to estimate wave properties accurately. Our scaling removes this problem for the signal-processing step, and is undone before we calculate physical wave properties.

*9.*MF is calculated after the exponential increase with altitude has been re-applied, so there can be no direct change in calculated MF as a result of this step. The only way something could go wrong with this step is if we had very large wave amplitudes at lower altitudes, then very small wave amplitudes at higher altitudes. This could conceivably cause these lower altitude waves to appear to dominate further up the granule than is fair, but we have not observed this in our analysis.

11. The precise order of these steps makes no difference as both operations are linear. Fortunately, the amplitude restoration factor involves the original temper-

ature perturbations T'(x,y,z) with the exponential amplitude increase removed (see Sect. 4.4, p.9 l.7). So, we restore it by comparing with the reconstructed temperature perturbations, which also have the exponential increase in amplitude removed.

12. We have restated this at the end of Sect. 4.4. We agree that this is a substantial amount, but our logic is that if we do not apply it, then our MF estimates will be equally uncertain, but exponentially lower. Furthermore, since we do not have a method for exactly calculating the amplitude reduction for each granule other than the one we have applied, our results would exhibit an unknown amount of underestimation that varies based on the number of wave cycles present of the dominant waves in each granule, which is also unknown. The uncertainty in the degree of uncertainty is why we chose to apply the correction on a case-by-case basis.

13. Since we do not consider very high frequencies in the 3DST, many spectral coefficients are close to zero, $\sim 10^{-6}$. However, the FFT of the original perturbations, while also relatively close to zero, might be of order $\sim 10^{-3}$, such that the restoration factor would be 1000 - obviously much too large to apply to the whole granule. We mitigate this effect by limiting restoration factors to between values 1 and 5, which we have found to be reasonable. Other coefficients outside this range are excluded from the median. The distribution of observed coefficients is approximately log-normal, with some very large outliers for the reasons above, and is thus better-characterised by the median than the mean. We are currently working to develop an improved version of this scaling based upon individual voxel-level scaling, but this is challenging due to the lack of *a priori* information about the wave field.

14. Corrected.

15. We agree this is unclear. Our point is that the loss of precision caused by using 8-bit integers falls well below the accuracy of the temperature retrieval, so does

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not contribute any extra uncertainty. We have rephrased the point to make this clearer.

16. To vertical scales. The text has been rephrased to avoid the confusion.

17. The term 'Southern Cone' has now been defined clearly in the text to refer specifically to the region we describe.

18. Wave amplitudes in Figs. 2, 3, 4 and 5 are shown with the exponential increase with altitude removed and the 3DST restoration factor (Sect. 4.4) applied. This is so that the wave phase fronts can be seen clearly on a single colour scale. Momentum flux values however have all been calculated with the exponential increase in altitude re-applied, i.e. our best estimate of the true value.

19. i The range of available vertical wavelengths are integer fractions of the total altitude range of the granule, i.e. 40/1, 40/2, 40/3, 40/4 ... 40/(N-1)km where N is the number of elements in the z direction. In this case N = 16, so the shortest (Nyquist limited) wavelength we can measure is 40/(16-1) = 2.67km. In practice, this is beyond the resolution of the dataset.

19. ii Methodologically no, but there is some dependence in the retrieved AIRS data: see Hoffmann and Alexander (2009) and Meyer and Hoffmann (2014), referenced in the paper.

19. iii Yes, and this is now more clearly mentioned throughout the paper.

19. iiii Potentially, yes. Vertical wavelengths seem to increase towards the top of the granule, just where edge-truncation for long wavelengths becomes more severe. But it should also be noted that this decrease could still be real, as the undersampling at the granule edge may be somewhat cancelled out by the MF increase due to

increased vertical wavelengths here.

20. The large group speed and phase speed arise due to the large difference between the background wind direction and the direction of the wave the analysis has identified in this region. This is probably methodological, and the uncertainty of the result here due to this has been made clearer in the text

21. This has been stated more clearly.

22.,23.,27. Indeed, observational filter limitations could be the cause of this. This is now stated in the text more clearly throughout.

24. Replaced with 'the upper height levels in our analysis'.

25. We agree, and the text has been modified in several places to reflect this.

26. Agreed, and clarified.

Other comments

All the specified changes have been made. Interestingly, the broken page reference for Wu and Waters (point 14) is also present in the BibTeX file provided by the publisher's website; we have removed page numbers entirely from this reference to deal with this.