A review report of the manuscript entitled "Stratospheric gravity waves at southern hemisphere orographic hotspots: 2003 – 2014 AIRS/Aqua observations" by L. Hoffmann, A. W. Grimsdell, and M. J. Alexander

This paper describes a concise and wise method to detect orographic gravity waves from hotspots distributed in the southern hemisphere middle and high latitudes by comparing gravity wave signature in two box areas windward and leeward of the hotspots observed by AIRS. The analyzed period covers about 12 years providing sufficient significance for the statistical results. In addition, based on careful correlation analyses, the authors made a simple model using thresholds for lower and upper level wind which predicts the occurrence of gravity waves detected by AIRS observations with a high score. This model is useful for future extended studies using AIRS observations such as wave flux estimate including geographic and interannual variability. Contents of this paper are quite interesting, well organized and hence has a significant value for publication. However, there are a few points which the authors may need to consider for improvement of the manuscript before publication. Thus, I recommend its publication in Atmospheric Chemistry and Physics after minor revision. Detailed comments are listed below.

Comments:

1. p.6 ll. 8-9: Please describe how orographic wave events are detected by visual inspection. Even visual inspection unwittingly uses some conditions to identify the orographic waves such as wavy phase structures and/or strong amplitudes. Are there any common characteristics in the cases when the two-box method failed and visual inspection succeeded in the detection?
2. p.10, ll. 29-30: Please describe the vertical wavelengths corresponding to the zonal wind thresholds obtained using (2). Are they close to the minimum vertical wavelength detectable by AIRS?
3. p.11 ll. 23-32: There may be one more factor influencing POD, that is horizontal wavelengths of gravity waves excited at each hotspot. AIRS detects horizontal wavelengths of about 100 km (p.9 l.5). However, small islands may generate gravity waves with small horizontal wavelengths which are hardly detectable by AIRS. In addition, such small-horizontal scale waves may not be able to propagate through strong westerly wind in the stratosphere. If we include a non-hydrostatic effect, the dispersion relation of gravity waves becomes

$$m^2 = \frac{N^2}{U^2} - k^2.$$

Orographic gravity waves generated by small horizontal-scale islands should have large k. The above dispersion relation formula indicates that m^2 can be negative in quite large U. In such condition, the waves hardly propagate upward and reflect downward at the level where

$\frac{N^2}{U^2} = k^2$. Does not this mechanism happen for the hotspots with relatively low score?

4. References in section 1 seem not sufficient. Suggested references are as follows.

a) p.2, ll.2-3: For orographic generation:

Aircraft observations:

- D. K. Lilly and P. J. Kennedy (1973), Observations of a Stationary Mountain Wave and its Associated Momentum Flux and Energy Dissipation, Journal of the Atmospheric Sciences, 30, 1135-1152

MST/ST radar observations:

- Ecklund, W. L., K. S. Gage, G. D. Nastrom, and B. B. Balsley (1986), A Preliminary Climatology of the Spectrum of Vertical Velocity Observed by Clear-Air Doppler Radar. Journal of Climate and Applied Meteorology, 25, 885-892.
- Sato, K. (1990), Vertical Wind Disturbances in the Troposphere and Lower Stratosphere Observed by the MU Radar, Journal of the Atmospheric Sciences, 47, 2803-2817.
- Worthington, R. M., and L. Thomas (1996), Radar measurements of critical-layer absorption in mountain waves. Quart. J. Roy. Meteor. Soc., 122, 1263−1282.
- Minamihara, Y., K. Sato, M. Kohma, and M. Tsutsumi (2016), Characteristics of Vertical Wind Fluctuations in the Lower Troposphere at Syowa Station in the Antarctic Revealed by the PANSY Radar, SOLA, 12, 116−120, doi:10.2151/sola.2016-026

p.2, ll.4-5: For adjustment of flow imbalance:

- Plougonven, R., and F. Zhang (2014), Internal gravity waves from atmospheric jets and fronts, Rev. Geophys., 52, 33–76, doi:10.1002/2012RG000419.

p.2, ll.9-10: For general discussion of gravity wave source in the summer and winter hemispheres:

- Sato, K., S. Watanabe, Y. Kawatani, Y. Tomikawa, K. Miyazaki, and M. Takahashi (2009), On the origins of mesospheric gravity waves. Geophys. Res. Lett., 36, L19801, doi:10.1029/2009GL039908.

p.2, l.11: Orographic hotpots in the southern ocean:

- Wu, D. L., P. Preusse, S. D. Eckermann, J. H. Jiang, M. T. Juarez, L. Coy, D. Y. Wang (2006), Remote sounding of atmospheric gravity waves with satellite limb and nadir techniques, Adv. Space Res., 37, 2269–2277, 2006

p.2, l.19: For gravity wave effects on PSCs:

- Alexander, S. P., A. R. Klekociuk, M. C. Pitts, A. J. McDonald, and A. Arevalo-Torres (2011), The effect of orographic gravity waves on Antarctic polar stratospheric cloud occurrence and composition, J. Geophys. Res., 116, D06109, doi:10.1029/2010JD015184.

- Kohma, M., and K. Sato (2011), The effects of atmospheric waves on the amounts of polar stratospheric clouds. Atmos. Chem. Phys., 11, 11535-11552. doi:10.5194/acp-11-11535-2011.