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Atmospheric Measurement Techniques Discussions

Interactive comment on "Variability of the Brunt-Väisälä frequency at the OH-airglow layer height at low and mid latitudes" *by* Sabine Wüst et al.

Anonymous Referee #1

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In their paper, the authors derive a climatology of the Brunt-Vaisala Frequency (BVF) at the OH airglow layer height using TIMED-SABER observations from satellite. The purpose of this climatology is to complement observations of OH airglow spectrometers that provide temperatures only averaged over the OH layer. With the help of the BVF climatology potential energies can be calculated from temperature fluctuations caused by gravity waves. A BVF climatology is therefore a useful tool for these kind of ground based observations.

Overall, the paper is well written and of interest for the readership of AMT. The paper is recommended for publication in AMT after addressing my major comment and my

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Discussion paper

additional comments.

Major comment:

It is well-known that atmospheric tides in the MLT can have strong influence on the BVF. Potential effects of tides should therefore be mentioned in the introduction, perhaps on p.3, after l.15. The first occurrence of the word "tides" is on p.6, which is way too late. In their paper, the authors investigate possible effects of tides, however effects of tides are not included in their BVF climatology. This should be mentioned in the abstract and the summary of the paper.

Several papers on tides observed with TIMED-SABER are relevant for the current study, but not considered. These papers should be mentioned in the introduction and some discussion be added, where appropriate:

Mukhtarov, P., Pancheva, D., and Andonov, B.: Global structure and seasonal and interannual variability of the migrating diurnal tide seen in the SABER/TIMED temperatures between 20 and 120 km, J. Geophys. Res., 114, A02309, doi:10.1029/2008JA013759, 2009.

This paper shows that near the mesopause the DW1 amplitude can exceed 10K at the equator and 5K at midlatitudes. Vertical wavelength is usually short (20-25km). Therefore the DW1 should have effect on the BVF and OH layer FWHM.

Pancheva, D., Mukhtarov, P., and Andonov, B.: Global structure, seasonal and interannual variability of the migrating semidiurnal tide seen in the SABER/TIMED temperatures (2002-2007), Ann. Geophys., 27, 687-703, 2009.

This paper shows that near the mesopause the SW2 amplitude is up to 10K at midlatitudes. Also this tidal mode should affect the BVF and OH layer FWHM.

There is also a climatology of eastward propagating tides:

Pancheva, D., Mukhtarov, P., and Andonov, B.: Global structure, seasonal and interan-

nual variability of the eastward propagating tides seen in the SABER/TIMED temperatures (2002-2007), Advances in Space Research, 46, 257-274, 2010.

showing that near the mesopause eastward propagating tides should have smaller amplitudes and smaller effect on the BVF and OH layer FWHM than the DW1 and the SW2.

Additional comments:

p.2, Eq.1: Please state explicitly that gamma=g/cp

p.3, l.12: Please state a typical value of the OH layer FWHM

p.4, l.24: Here you use a latitude range of 60S to 60N. However, TIMED-SABER covers only 50S to 50N continuously. Therefore the information should be included that latitudes 50 to 60 deg are an extrapolation when TIMED-SABER views toward the other hemisphere.

p.5, l.4-7: Please state here that also local time is relevant!

p.5, l.20: Please mention that also tides should have effect on the FWHM of the OH layer (due to temperature variation and secondary circulation induced by tides). Therefore the 60d oscillations could be related to the yaw cycle of the TIMED satellite and to changes in the local time of TIMED-SABER observations.

p.5, l.33: again: TIMED-SABER observes continuously only between 50S and 50N!

p.6, l.9: Please state that only nighttime TIMED overpassings are considered in Fig. 3.

p.6, l.9: Please clarify whether these overpass times are the satellite overpassings, or the local time of TIMED-SABER observations. As TIMED-SABER views sideward, there should be a considerable difference!

p.6, l.20: what is R^2 ? The linear correlation coefficient squared? However, it should be pointed out that the annual cycle was not taken out, and this will increase the scat-

ter in Fig. 4. Consequently, the linear relations shown in Fig.4 could be much more significant than suggested by the correlation coefficients. As amplitudes of tides vary strongly during one year, the linear relations should also be time dependent.

p.6, l.24: Again, not clear whether low Rˆ2 values are meaningful! The correlation could be better if seasonal variations are accounted for.

p.6, l.26: This question is somehow out of place as it suggests some surprising effect! It is however well-known that tides have significant effect on the MLT!

p.6, l.26-30: There are several papers that quantify tides derived from TIMED-SABER temperatures. See my major comment.

p.7, l.19: See the paper by Pancheva et al. (2009) for effects of semidiurnal tides.

p.8, l.26: "artificial oscillation" is not a good expression here! The oscillation arises from sampling tides at different phase. State clearly that tidal effects are neglected and not included in the climatology.

p.8, l.28: how is the "quality of approximation" defined? Please explain!

p.10, l.9/10: It should be stated clearly that tidal waves will have some effect on the BVF, and this effect is not considered in the climatology.

Other comments:

p.3, l.5: high enough -> good enough

p.3, l.5: mistime -> miss-time

p.3, l.6: misdistance -> miss-distance

p.6, l.18 simoultaneously -> simultaneously

p.7, l.5: agress -> agrees

p.7, l.16: seperated -> separated

p.8, l.18: charaterized -> characterized

p.8, l.28: summerized -> summarized

p.9, l.1: asymetries -> asymmetries

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