Author's response on

Interactive comment on "Thermal structure of the mesopause region during theWADIS-2 rocket campaign" by Raimund Wörl et al.

Anonymous Referee #1 Received and published: 7 September 2018

by Raimund Wörl et al.

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A review on the paper "Thermal structure of the mesopause region during the WADIS2 rocket campaign" by Raimund Wörl, Boris Strelnikov, Timo P. Viehl, Josef Höffner, Pierre-Dominique Pautet, Michael J. Taylor, and Franz-Josef Lübken Although the paper provides no new knowledge about the temperature regime of the mesopause, solar tides and gravity waves, the paper is interesting in terms of a comparison of simultaneous temperature measurements by three independent instruments (the rocket CONE instrument, the IAP Fe lidar and the AMTM mapper).

I recommend the paper for publication after minor revisions.

Minor comments:

P. 6, L.17: "unclear wave structures" It is better to replace it with "random wave structures".

changed

P. 6, L. 18-19: "A linear fit of the phase is used to estimate the phase slope for every component: a vertical wavelength and a phase are calculated using the slope and the position of the fitted lines at 86 km."

This is the most problematic issue. I do not understand this technique of estimating a vertical wavelength, having just a 15 km altitude range of the data profiles shown in Fig. 5. Some strong assumptions are required. This technique should be clarified in more detail. Besides, uncertainties for the estimated vertical wavelengths and phases should be presented in Table 1.

page 7, line 31: a short explanation is added

P. 8, Capture to Fig. 5: "Figure 5. Amplitudes (a), (c) and phases (b), (d) ..." Labels (c) and (d) should be swapped around.

changed

P. 12, L. 27-29: "A vertical wavelength (at about 90 km) in the range of 30–35 km (24 h tide) and 20–30 km (12 h tide) in that analysis is in good agreement with the findings in this study (40 km and 22 km)."

First. In Table 1, a vertical wavelength of 43 km for the 24 h wave is shown (not 40 km). Second. Having vertical wavelength of 30-35 km (from Forbes, 1982a) and the found vertical wavelength of 43 km, one cannot say that "it is in good agreement". This sentence should be corrected/rephrased.

numbers are updated in the table and the text

page 13, line 31 ff. and page 14: text is corrected and rephrased

P. 13, L. 1-2: "Winds from radar measurements and temperatures from airglow measurements at polar latitudes are discussed relating the 8 h and the 6 h tides (Younger et al., 2002; Wu et al., 2005; K. Smith et al., 2004)."

It is worth indicating here that Dalin et al. (2017) have demonstrated significant solar tidal components (24h, 12 and 8h) both in the PMSE strength and wind velocity components in the polar mesopause.

Page 14, line 20: Dalin et al. (2017) is mentioned

P.13,L.4-5: "This is in good agreement with our finding of 30 km."

In Table 1, a vertical wavelength of 23 km for the 8 h wave is shown. This value should be corrected.

numbers are corrected

P. 14, L. 7-9: "...suggest an OH centroid altitude between 84 km and 86 km. However, in context of this paper such statements refer only to the observation in this single night and the assumption of a fixed altitude and layer shape is not justified in all cases (e.g., Zhao et al., 2005; Dunker, 2017)."

It is worth adding other important references of this important topic on the variability of OH layer characteristics in height and time: Perminov et al., 1999; Melo et al., 2000; Liu and Shepherd, 2006; Khomich et al., 2008; Grygalashvyly et al., 2014.

Additional references

Dalin, P., S. Kirkwood, N. Pertsev, V. and Perminov (2017). Influence of solar and lunar tides on the mesopause region as observed in polar mesosphere summer echoes characteristics. Journal Geophysical Research-Atmospheres, 122. https://doi.org/10.1002/2017JD026509.

Grygalashvyly, M., G.R. Sonnemann, F.-J. Lübken, P. Hartogh, U. Berger (2014). Hydroxyl layer: mean state and trends at midlatitudes. J. Geophys. Res. Atmos. 119, 12391–12419. http://dx.doi.org/10.1002/2014JD022094.

Khomich, V.Yu., A.I. Semenov, N.N. Shefov (2008). Airglow as an indicator of upper atmospheric structure and dynamics. Springer-Verlag, Berlin, Heidelberg. http://dx.doi.org/10.1007/978-3-540-75833-4.

Liu, G.,and G.G. Shepherd (2006). An empirical model for the altitude of the OH nightglow emission. Geophys. Res. Lett. 33, L09805. http://dx.doi.org/10.1029/2005GL025297.

Melo, S.M.L., R.P. Lowe, and J.P. Russell (2000), Double-peaked hydroxyl airglow profiles observed from WINDII/UARS, J. Geophys. Res., 105, D10, 12,397-12,403.

page 15, line 31: additional references are mentioned