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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quasi 18-hour wave activity in ground-based observed mesospheric H_2O over Bern, Switzerland" *by* Martin Lainer et al.

Anonymous Referee #2

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The authors analyse gravity waves based on microwave water vapour observations in the mesosphere. They also investigate mesospheric winds based on microwave radiometer observations, and analyse WACCM GCM model results and EOS Aura satellite data. They find that waves with ∼18 hr period are frequently seen in the mesosphere. The topic is suitable for ACP. In particular, the microwave observations are of interest to the community and the paper deserves publication in principle.

However, the analysis of wave parameters from the WACCM model and Aura data is partly unclear and to a certain degree questionable. The authors use model and observations with vertical resolution of several km, so I do not see how waves with wavelengths < 6 km should be resolved. At least major modification is required.

Major issues

WACCM model results: a resolution of 2.5° means that only waves with wavelength > 400 km or so are resolved. So this is certainly a different part of the spectrum than observed with the microwave radiometer. Figs. 4 and 5 show that the spectra are completely different, and the only commonality is the height range, where the waves maximise. But this is only a similarity and one cannot really identify common waves in the model and observations.

The hodograph analysis in Fig. 13 requires explanation. There is some theory given in section 3, but it is not well described what the authors really did to obtain the wave parameters. Obtaining the intrinsic frequency from ïĄě and then using the Doppler relation to get the horizontal wavelength? How was the observed frequency defined, from the radiometer measurements? And what is the error of this analysis? If the intrinsic frequency and horizontal wavelength is known, the dispersion relation will give the vertical wavelength, but from Fig. 13 a vertical scale of some 20 km is visible, is it possible that the difference 20 km vs. < 6km comes from uncertainties of the analysis? ïĄě is close to unity, and then a relatively small error might give a large relative error for the wavelength. WACCM cannot resolve waves with short vertical wavelength. The authors refer to Baumgarten et al. (2015), but in their wind and temperature residuals the short wavelength is immediately visible.

Aura/EOS observations: The vertical resolution is less than 3 km, so I do not see how waves with wavelengths < 6 km can be resolved. The description of Fig. 14 is not very clear. I assume that it shows temperature residual profiles every 12 hr? In the mesosphere, Fig. 14 shows maxima/minima constantly at the same level. This does not look like a real atmospheric phenomenon, and it rather seems as if these are the original data levels and the waves seen are due to aliasing. Analysis of Aura data therefore must be explained in much more detail, and possible effects of resolution have to be discussed. I doubt, however, that the results in Fig. 14 really show the gravity waves.

Minor issues

P 2, introduction, l 13: The paragraph on the solar effects may be deleted. At least regarding the 11-year cycle, as the paper deals with gravity waves and not long-term, interannual variability.

P3, L7: maybe replace “frequency by “angular frequency”, at least when first introduced.

P9, L20, Fig. 10: How was the correlation calculated? For each profile separately, so that the correlation is strong if the amplitudes maximise at the same height? This would not mean too much, in particular would not give information on whether the amplitudes appear simultaneously or not. If the correlation is insignificant, is it then simply set to zero?

P11, L 13: “temperature amplitudes”, do you mean “residuals” or filtered temperatures as in Fig 14?

P11, L 21: how do you know that it is the 18 hr wave that is analysed from the temperature profiles?

P 11, L 23: Which kind of temporal structures? Long-period variations of the waves?

Fig 13, caption: what means “background wind speed?”

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