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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A QBO-signal in mesospheric water vapor measurements at ALOMAR (69.29° N, 16.03° E) and in model calculations by LIMA over a solar cycle" *by* G. R. Sonnemann et al.

Anonymous Referee #1

Received and published: 17 February 2009

This manuscript reports about a QBO-like signal in the water vapour distribution in the altitude range between 40 km and 80 km above at high latitudes in the northern hemisphere. This result is based on a FFT analysis of ground-based water vapour measurements carried out above ALOMAR (69°N) from 1996 to 2006. The measurements have been compared with GCM calculations, which exhibit the QBO feature as well. The manuscript is well written and I recommend a publication in ACP after some minor revisions.

General comments:

The gaps in the measured water vapour time series introduce a complication for the spectral analysis. Could you please add some lines how you dealt with this complication?

Figure 1 is one of the key plots in this manuscript and I think it deserves a little bit more detailed description. For example, with respect to the discussed phase shift of the QBO in 2000/2001, but also for a motivation of the chosen altitudes (50 km, 60 km, 70 km, 80 km) used for the spectral analysis.

The discussion around figure 6 presents some interesting insights, however it appears somewhat unconnected to the material presented before. Can you motivate it more.

I wonder if you tried to analyse the data set, separated, for example, according to the easterly and westerly phase of the QBO or before and after 2001, respectively.

I was somewhat surprised not to find anything about the MQBO, which gives at least a description of the QBO in the mesosphere in tropical latitudes.

Text issues:

page 885 line 8/9 - I would be rather careful here. Deep convection is certainly important to transport water vapour towards the TTL, but the main outflow level is in general at about 200 hPa, i.e. well below the tropopause. Convection rarely penetrates the tropopause! Horizontal transport and gradual ascent through the TTL are much more important for the dehydration. Note also that the hygropause can be occasionally observed 1 km to 2 km above the cold point tropopause, which is resolved by the tape-recorder effect. For more information see Fueglistaler et al., 2008RG000267, in print.

page 886 line 6-10 - The description of the ground-based microwave technique appears to be rather general in the beginning, however the references are rather one-sided. Might be fair to implement some references to Bevilacqua or Nedoluha.

page 886 line 16 - 'converted down' - Might be worth to mention that this means a

ACPD

9, S270–S272, 2009

down conversion in frequency, which makes the signal detection easier (technically).

page 886 line 21/22 - 'the inferred values could be somewhat underestimated' - This is certainly interesting to see in comparison to satellite-borne results from e.g. AIM, Odin or ACE. These instruments show definitely higher concentrations and a by far weaker gradient, especially above 75 km. Is this an issue with the signal at the uppermost data bin?

page 890 line 25 - 'freeze-drying of water at the hygropause' - see comment above. 'freeze-drying of water in the TTL region' would more appropriate.

page 893 line 5 - 'Brewer-Dobson circulation controlled by the QBO'. 'modulated' instead of 'controlled' appears to be much more appropriate.

Typos:

(1) page 884 line 4 - 'interuptions' should be 'interruptions'

page 885 line 7 - one of the two 'both' needs to be removed

page 888 line 21 - 'gapes' should be 'gaps'

page 889 line 5 - 'penal' should be 'panel'

(5) page 894 line 4 - 'midlatitudev' should be 'midlatitude'

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 883, 2009.