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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.

G. R. Sonnemann et al.

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Dear Referee,

Thank you very much for your comments on the paper. We have tried to follow your suggestions and take your remarks into consideration. Different changes and insertions relate to comments of the second referee.

We use ORIGIN 6.0 for the FFT analysis which needs equidistant data. The water vapor data are diurnally averaged values. For smaller interruption one could interpolate to fill the gaps. But for larger interruptions this is an impossible procedure. There-

fore, as we have no information about the real water vapor variation for the period of interruptions, we use values of the mean annual variation of the water vapor mixing ratio calculated from the whole monitoring period. As the interruptions were a point of criticism we excluded now the first and third interruption and the data before the first and after the third interruption. The analysis is based now on eight years between July 1997 and August 2005. The surprising result was that the QBO peak with a period of about 27 months became clearer and is practically identically with that peak of the LIMA calculations calculated for the same period.

We extended the discussion of Fig. 1. This was also a recommendation of referee#2. We used levels with a 10 km distance as they represent typical mesospheric layers (stratopause, lower and middle mesosphere, and upper mesosphere/lowermost mesopause region).

We have also extended the discussion of Figs. 6. The sense was to show that the vertical upward transport connects water vapor at 50 km with that at 70 km. This connection is strongest in summer when the vertical wind is largest. Although water vapor reaches its maximum in the stratopause region in late summer/early autumn the correlation between both heights becomes poorer as the vertical wind becomes weak and inverses finally. In order to better represent the correlation we have changed Figures 6a and 6b from portrait to landscape mode.

We inserted a very brief introduction of the MQBO and quoted some papers about this subject.

We specified the discussion of the dehydration. It is not a direct topic of the paper but only indirectly because a changed water vapor input into the stratosphere is also a reason of the variability of mesospheric water vapor.

We have added different new references and gave Bevilacqa and Nedoluha more credit.

ACPD

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It is true that different satellite measurements retrieved larger water vapor mixing ratios at the 80 km panel. This was clearly stated in Nedoluha, G. E. and P. Hartogh, Upper stratosphere comparison (WVMS and WASPAM), in Stratospheric and Their Role in Climate (A Project of the WMO/ICSU/IOC World Climate Research Program): SPARC Assessment of Upper Tropospheric and Stratospheric Water Vapor, edited by D. Kley, J. M. Russell III, and Phillips, WMO/TD 1043, pp 139-141, World Meteorol. Org., Geneva, 2000. The discrepancy between model calculations and measurements at 80 km will be demonstrated by the amplitude of the annual period which is essentially stronger for the LIMA data. The LIMA data seem to overestimate somewhat the amplitude of the annual variation at 80 km, but it could also be that the microwave measurements underestimate the mixing ratios because the retrieved value needs a-priori information for the domain above. The signal contains information up to infinity with strongly decreasing influence toward greater heights. It is, of course, also possible that the satellite instruments overestimate the values at this height because they also need a-priori information from the domain above and besides different data inversion problems arise for satellite observations. We have corrected different mistakes listed in your review. Yours sincerely,

Gerd R. Sonnemann.

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

ACPD

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Interactive Comment