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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.

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Dear Referee,

Equidistant spaces are a prerequisite for the FFT analysis. The data gaps and interruptions have been filled with values got from a mean annual variation of the water vapor distribution derived from all years of observations. (We thank for this necessary comment which we have redressed now. We tried to make the paper as brief as possible.) As, indeed, the large interruptions in the beginning and end of the observation period may deteriorate the results we employ now only the data between July 1997 and August 2005. In these sequence of eight years data only one interruption occurs. The

new FFT analysis shows practically an identical spectrum of periods to the independent analysis of the LIMA data calculated for the same period. The only exception is the annual peak at 80 km. The LIMA model also calculates, of course, the water vapor mixing ratios for all gaps and interruptions. The significance of the periods is mirrored by the amplitudes of the periods.

All observation methods possess somewhere highest uncertainties of the measured data, normally at the beginning and end of the measuring interval. E.g. the occultation measurements have largest uncertainties for small absorption signals. In order to invert the measured quantities into densities one needs a-priory information for the domain above the first measuring height. The same is true for the microwave technique.

The noise of the considered quantities can be clearly seen in the spectrum of small periods. A quasi two year variation is not influenced by the high frequency noise.

We have first to state that both model results and observations shows in their spectrum a clear signal of quasi two years namely 27 months which is very close to that period of the stratospheric wind in the tropics. It is another subject beyond the frame of this paper to investigate the mechanism of a possible connection between the tropospheric/stratospheric QBO and a signal of quasi two years in the mesosphere of the high latitudes. We could mention that the residual circulation in the middle atmosphere is most probably the link between both phenomena, but a deeper discussion of the theoretical background is an own subject and lies outside of the intension of a brief comment. According the ERA40 data (Charlton end Polvani, 2007) major warmings occurred during the considered period on 15th December of 1998, 26 February of 1999, 20th March of 2000, 11th February of 2001, 17th February 2002 and according to NOAA CPC at the beginning of January 2004 and beginning of March 2005 (http://www.cpc.ncep.noaa.gov). Minor warmings occurred in the later December of 1997 and January and February 2003 (http://www.cpc.ncep.noaa.gov). Meaning SSWs (major and minor) occurred each between July of 1997 and August 2005. Both, major and minor warmings lead to increasing water vapor in the mesosphere. Thus,

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interchange of years with and without of SSW can not be a reason of 27 months period. Additionally, the QBO is not an effect occurring only in winter. The clearest QBO signal is to recognize in summer but in summer no SSWs occur.

The SSWs have a considerable influence on the water vapor distribution in winter. This is clearly to recognize by the water vapor enhancement during SSW events. The question of increasing water vapor during SSW was discussed 3 years ago (Sonnemann et al., 2006).The subsidiary peak in water vapor after winter solstice agrees very well with the statistics of the SSWs according to Charlton and Polvani (2007).

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

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Interactive Comment