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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of the mesospheric semi-annual oscillation (MSAO) in water vapour by Odin/SMR" *by* S. Lossow et al.

Anonymous Referee #2

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This is a very interesting paper showing ODIN/SMR mesospheric and even lower thermospheric water vapor variations in the tropics and mid-latitudes. This is a region where diurnal variations can confuse the seasonal signatures, and the authors seem to have done a good job in taking these into account. The paper presents and interesting comparison with a previous study of this region with HALOE, which necessarily provided much sparser sampling.

My only serious worry with this paper is that the annual cycle shown at northern mid-latitudes in the upper mesosphere goes 'off the scale' at over 1 ppmv. Even if the color doesn't change here, the authors should show the contour lines here. As is, the authors merely state in the text 'At 35 N the amplitude exceeds 1 ppmv in that altitude range.' What is that number? Is it unrealistic? Is it an indication of a problem with the

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data? In this, as for various other amplitudes, the authors argue that the variations in HALOE are smaller because of an undersampling problem in the HALOE data. This argument is fine to start with, but the authors should also directly compare their coincidences with HALOE in the subtropics and see if the seasonal variation is the same. If not, then it’s not a sampling problem.

The remaining comments mostly just reflect minor requests for additional information.

'The mesospheric SAO in water vapour has so far only been addressed by Jackson et al. (1998), based on HALOE measurements between the end of 1991 and the beginning of 1996.' The Mesospheric SAO in water vapor was reported with ground-based radiometers well before Jackson et al. (1998). References include: Bevilacqua et al., JGR 95, 883-893, 1990. Nedoluha et al., JGR, 101, 21183-21193, 1996. The latter reference even shows the hemispheric asymmetry using 2 ground-based stations.

'The water vapour emission line covered by the measurements is centred at 556.936 GHz.' This sentence shouldn’t be a paragraph by itself.

'Above 90km the retrieval precision can easily exceed 50%.' I don't think you can say 'retrieval precision exceeds ...'. Perhaps 'random error' or 'random uncertainty' would be a better word than 'precision' here.

Figure 1 - A 1000 km difference in these comparisons could lead to a large bias if there is a difference in the average latitude offset between the satellites. It would be comforting to hear in the text that results with 500 km differences were similar.

The authors have clearly worked hard to get a good tidal correction, and I think their estimates of the correction would be of interest to anyone else trying to perform a similar study with other instruments. The authors either need to quantify what they mean by the phrase 'tidal contributions are rather small', (i.e. give some upper limit), or perhaps present their correction factors in a table.

While the authors have worked out the tidal issues, they seem to have ignored diurnal

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variations due to photodissociation. This is probably important at 85-90 km, especially in the tropics. If it's not important, please at least give an approximate estimate as to its effect.

Is an annual variation term included in the calculation of Fig. 5?

'In addition to semi-annual and annual variations described here we also found a small QBO and a 90 day time variation.' Where the QBO and 90-day terms generally included in the fitting routine, or was this just an additional check?

'Furthermore, the minimum between the two maxima is not statistically significant in the UARS/HALOE evaluation.' Is this statement made in Jackson et al. (in which case it should be specifically referenced) or did the authors do this calculation themselves.

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