Response to referee comments, referee 2

We appreciate the referees' comments and have addressed their suggestions where appropriate in order to improve the paper. The comments, suggestions and corrections given by the anonymous referee are numbered below as they appear in the text with the response in the following paragraph named Rn (with n being the question).

1.
The abstract states that: “Daily variations of water vapour have been observed and due to the long chemical lifetime of water they are assumed to be caused by changing wind patterns which transport water-rich or poor air into the observed region.” I think “Daily” should be “Diurnal”, since, as far as I can tell, none of the data presented is from just a single day.

R1.
"Daily" has been changed to "Diurnal and semidiurnal" for the above reason, and to accommodate for both diurnal and semidiurnal variations.

2.
The manuscript is actually unclear as to what time integration is required for these measurements. On the one hand, on page 31269 says: ” Even during moderate atmospheric conditions (background temperatures K) the high sensitivity of the ∼150instrument allows retrieval of reliable atmospheric profiles up to the mesosphere every six hours.” Then Figure 1 shows averaging kernels that, by implication, seem to be from a 6-hour integration. But then, on page 31270 the authors state: “In order to detect variabilities at short time-scales in the upper region the usual integration time of six hours is not enough.” They then go on to state that they add up measurements in 6-hours windows over a full month in order to get Figure 4. This makes sense, but it is seemingly at odds with the previous claims that only 6 hours are needed. I think the problem is that what the authors call a “reliable measurement” is still not of sufficient quality to detect tides. In order to clarify things the authors need to make a quantitative statement of the random error at 80 km of a single 6-hour measurement which can be compared to the variations in VMR observed in Figure 4. Also, it would be useful to know the influence of the a priori at this altitude.

R2
In general, the parts discussing the integration time has been rewritten to better explain the integration time needed. The caption to Figure 1 now clearly states that the averaging kernels show a 180 h integration time dataset. A short discussion on the influence of the a priori for the whole retrieved range was also included.

3.
31269 line 5 should be “acts”, not “act”

R3
Corrected

4.
Equation (1) – Is the spectral noise in the two spectrometers significantly different? Unless I'm missing something important here (and maybe I am) I don't see why this needs an equation. Simply state that the measurements are being added with weighting based on the spectral noise for each spectrometer.

R4
Correct, the weighting function is nothing new and as is does not add any information to the paper it has been removed.

5.
Figure 4 is referenced before Fig. 2 and Fig. 3

R5
Corrected

6.
"As expected from conservation of energy the amplitude of the tidal waves increase as the pressure decrease with altitude." I'm not sure how the authors can conclude this. The measurements show variations in VMR, and these will vary to a large extent based on the gradients (both horizontal and vertical) in H2O. There simply is not enough information available to draw this conclusion.

R6
This is true and a deeper discussion on the matter would be out of the scope of the paper and this part was therefore removed.

7.
"Furthermore, the decreased sensitivity of the instrument at higher altitude will slightly drag the retrieved profile to the a priori profile and dampen deviations from the mean." As mentioned previously, it would be good to know how important the a priori is. There are equations for calculating the influence of the a priori profile.

R7
See R2.

8.
"In contrast to the strong seasonal variability (almost a factor of three at 70 km between summer and winter (Seele and Hartogh, 1999)) in the background levels of water vapour the absolute amplitudes of the tidal components are constant over the year." I think what the authors are trying to say is that: "The variations in water vapor caused by tidal components are much smaller than the seasonal variability at 70 km". The phrase "constant over the year" is particularly confusing, since, fractionally, there are very large changes in amplitude throughout the year.

R8
Rewritten.