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Reply to the referee # 3

Cloud sensitivity studies for stratospheric and lower
mesospheric ozone profile retrievals from measurements of
limb scattered solar radiation

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The topic of this paper is very interesting to all scientists making limb measurements in the UV-visible spectral range. It is carefully written and content corresponds to the title. I can recommend it for publication in AMT. Some comments follow.

Comments:

1. It would be interesting to know what are the errors in the cloud free case when realistic instrumental errors are included in the simulation. This would give the scale for errors from clouds. You mention synthetic data: is noise included in data?

Author: Noise is not included in the synthetic data. The effect of instrumental random noise on the retrievals is negligible. This is partly, because we use 2 nm wide windows when determining the limb radiance profiles.

2. Sec. 3 p.385 line 3: The method in Tukiainen et al. uses simultaneously wavelengths from UV-Visible.

Author: Thanks for pointing this out. This was changed in the text.

3. Authors put a lot of effort to derive Eq. (21). This equation is an approximation and in some cases leads to completely wrong results as the authors admit. In my mind this derivation is a sidestep from the main idea of the paper i.e. to estimate errors from clouds. Could this part be shortened?

Author: In accordance with comments of reviewer 2 we have extended the discussion of the retrieval errors referring to Eq. 21 much more as before. We think this increases the weight of the equation in the paper and would like to keep the discussion around Eq. (21) unshortened.

4. In Sec. 5 p. 390 line 1: .."absolute limb radiances"... Do you mean original radiances or normalised radiances Eq. 1? This question applies to all subsequent use of "absolute radiance". Probably it would be more meaningful to consider normalised radiances because they are the starting point for retrievals?

Author: In the sentence referred to by the reviewer "absolute limb radiance" corresponds to the not-normalized limb radiance. This was mentioned a few lines above. **Also in the remaining text "absolute radiance" always refers to not-normalized radiances.** Regarding the suggestion to consider normalized radiances we also followed the recommendation by reviewer 2 to include a

plot with the normalized limb radiance profile at the center wavelength of the Chappuis-triplet in Fig. 1–3.

5. It would be useful to show a plot of the measurement considered. Instrument, sun, clouds, albedo and few possible paths for solar light.

Author: This is a good suggestion, and we included such a plot as the first figure.

6. I am missing a discussion about the spatial extent of the clouds and albedo (see for example Oikarinen, JGR, 107, 4404, 2002). The paper assumes uniform cloud and albedo. Have you considered any more complicated cases?

Author: This is another good point, but the RT model used for the sensitivity analysis doesn't allow one to consider horizontally inhomogeneous clouds. Oikarinen used a Monte-Carlo model that makes the treatment of horizontally inhomogeneous cloud cover possible.

7. Appendix is awfully long. Do you see any possibility to shorten it?

Author: We see no reasons to shorten the Appendix. The main purpose of the Appendix is to provide a detailed discussion to the reader who want to go in details as deep as possible. The readers who are not interested in details can skip the entire appendix.