Response to Referee #1: Greenhouse gas profiling by infrared-laser and microwave occulation: Retrieval algorithm and demonstration results from end-to-end simulations

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We thank the reviewer for the helpful and constructive comments which we will fully take into account in the revision of the paper. Please see our detailed responses below (comments of reviewer italicized, author response below each comment).

- **Comment to page 2278:** *Here is stated, that the current stude will handle only cloud-free scene. Here it would be interesting, who realistic this assumption is, e.g. how many cloud-free scenes are roughly expected (which will not be that much in occultation).*
  In the companion AMT paper Schweitzer et al. (2011a) a brief discussion for cloud influence on LIO occultation events is given, including of an assessment based on solar occultation data of the Canadian Atmospheric Chemistry Experiment (ACE) on when cloud top altitudes are reached that limit tropospheric penetration of occultation events. In order to clearly point to this in the revised manuscript, we will amend the sentence on p. 2278, line 9, by "; a brief discussion of cloud influences, including limitations to tropospheric penetration of part of the events especially in the tropics, is given by Schweitzer et al. (2011a)."
- **Comment to page 2279, second Paragraph:** *A sentence about the expected regional distribution and the number of events of the planned configuration would be appreciated here.*
  Following the suggestion of the reviewer we will change the respective sentence on p. 2279 to the more informative form "We used LEO satellites in sun-synchronous orbits, two transmitters and two counter-rotating receivers, with the transmitters at an orbital height of 800 km and the receivers at 650 km, yielding about 230 globally well distributed occultation events per day (same as Schweitzer et al. (2011b))."
- **Comment to page 2280:** *For the simulations, also an aerosol free atmosphere is assumed, which is never the case. Therefore, I would expect at least a qualitative statement somewhere in the paper, which errors are expected for a background aerosol loading. Or the other way around: at which point the assumption of no*

aerosol is important for this study.
We referred to the aerosol extinction, and why we can reasonably assume aerosol-free air and neglect other small influences for the purpose of this study, in section 2.1 on p. 2277 in the bottom paragraph (extending over to p. 2278 top paragraph). In order to explicitly remind on this again on p. 2280 in line 16 we will enhance this sentence to "The atmosphere is assumed to be free from clouds and aerosols (cf. discussion in Sect. 2.1); hence..."

- **Comment to page 2308:** *For O_3 , it is stated that ozone profiling is possible starting 10–15 km, depending on latitude. However, looking at the result in Fig.9 b,d,c), I saw reasonable profile starting at 12 km for SAW, 14 km for STD, and at least 16km for TRO. Therefore, this examples leads to reasonable ozone profiles rather start at 12–16 km.*
  Fig. 9 shows errors of an individual retrieved profile and our statement is meant to roughly capture the statistical (standard deviation) error that is typical for the O_3 retrieval (and that we roughly know from additional retrievals, not shown, of a small number of profiles). But we agree that it is somewhat approximate within one or two kilometers to specify such ranges. We will accordingly weaken our respective sentences on p. 2308, from line 19 onwards, by additonal use of words "about" as follows "...and further down below about 10 km also the H_2O..."; and in the next sentence "profiling of stratospheric ozone above about 10 km to 15 km." We will also make sure to have this weakened accordingly with "about" also in the abstract (p. 2274, line 22) and the Summary and conclusions (p. 2311, line 14).

- **Comment to page 2304ff:** *last paragraph / page 2326, Fig.7: From Fig. 7c, I would conclude, that $H_2O(4)$ gives almost no additional information, because the $H_2O(3)$ already covers 8–10 km with smaller errors. Can you comment on this?*
  The $H_2O(4)$ channel is designed to cover heights below 8 km only, i.e., the lowest part of the upper tropsphere, and its relevance quite depends on the moisture content. Since Fig. 7 is based on the FASCODE standard (STD) atmosphere the moisture content is not that strong. The real value of this channel is to support the very moist tropical conditions where $H_2O(3)$ alone would not be able to fully cover down to 5 km. In order to explicitly point to this we will amond the sentence on p. 2304, line 28, as follows "...behavior described above; the contribution of the $H_2O(4)$ channel is limited in this STD atmosphere case, its value is to support the very moist tropical conditions."
  Related to this we also found we did not clearly note that all example figures in Sect. 3.4 and 3.5 use STD atmosphere, we will thus also amend the respective sentence in Sect. 2 on p. 2280, line 9, as follows "...atmospheres (STD atmosphere for the example cases illustrating the algorithm steps in Sect. 3.4 and 3.5, all three atmospheres for the demonstration results in Sect. 4)."

References

Schweitzer, S., Kirchengast, G., and Proschek, V.: Atmospheric influences on infrared-laser signals used for occultation measurements between Low Earth Orbit satellites, Atmos. Meas. Tech. Discuss., 4, 2689–2747, doi:10.5194/amtd-4-2689-2011, 2011a.

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