Reviewer report on the amt-2011-37 paper «Atmospheric influences on infrared-laser signals used for occultation measurements between Low Earth Orbit satellites» by S. Schweitzer et al.

The paper discusses the influence of the atmosphere on laser light propagation in the novel laser occultation technique. The paper deserves publication in AMT after a revision. Comments are below.

Comments on presentation

1) I think that the paper would benefit from a more clear and concise description. For example, it is stated three times in pages 2695-2698 (essentially, in one subsection) that the LIO propagation simulations were performed with EGOPS+xEGOPS system; a paragraph about "interesting" and other atmospheric effects in page 2695, lines 15-24, contains essentially the information that laser light is refracted, absorbed and scattered in the atmosphere (as all effects are discussed below), etc.
I recommend the authors to revise the text, in order to clarify/shorten the description and avoid multiple repetitions and multiple references to the text below.

2) The "defocusing effect" discussed in the paper is known as "refractive attenuation" or "refractive dilution" in the literature.
The term "atmospheric loss" can be misleading. The term "extinction" is used in scientific literature for this effect.
I recommend using the standard terms.

3) Section 1. Logic of introduction: you mention that SWIR and MW signals are used together, then discuss SWIR measurements, then MW measurements, then again SWIR measurements. Maybe, it would be better (more logical) to write first about MW measurements, and then concentrate on SWIR measurements.

4) I recommend avoiding the scientific jargon like "grey literature" or "assessed from scratch".

Detailed comments on contents

1) It is important to note in page 2703 that MW refractivity in Smith-Weintraub formula does not depend on wavelength (otherwise it might look strange to state that MW and SWIR refractivity are compared, while comparing two different formulae for SWIR wavelengths).

2) Authors state in page 2705 line 5 "The oscillating features in the profiles stem from strong temperature gradients around the tropopause". Indeed, the air density structure near the tropopause acts as a lens and produces non-monotonic profile of refractive attenuation (like green line in Fig.3). However, the oscillations like in red line are not expected (the red curve looks like erroneous). The refractive attenuation is related to smooth air density profile (excluding fluctuations caused by e.g. gravity waves). Another reason for oscillations on the red profile might be numerical instability of computations. I suggest checking that the refractivity profiles used in calculation of refractive attenuation are smooth.

3) page 2715: Was the total influence computed as a sum of all "losses" or it was estimated using the simulator with all effects included? Please clarify.

4) P. 2692 l.7 and p.2724, l.14 : "turbulence strength" - what parameter is assumed here?

5) P. 2692 l.25 -> The sentence "This ~~are~~(is) a self-calibration step…" The self-calibration does not necessary guarantee "very accurate retrieval results": high signal-to-noise ratio is also required. It does not also guarantee "free-of-bias" retrievals, because a bias can result from other sources, e.g., from spectroscopic uncertainties.

6) P.2695: Scintillations are also due to refraction.

7) P.2720: "Saturation occurs, when a signal is repeatedly scattered along a (long) propagation path". I do not understand this. Signal is scattered at all tangent altitudes in the atmosphere. What causes the saturation and what defines the altitude range where it occurs?

8) P.2720: "scintillation noise" – Scintillation is not noise.

9) P.2720: I suggest including also the references on laser occultation experiments (in addition to or instead of the reference on stellar scintillation measurements) and discuss applicability of these observations to ACCURATE mission.

- Takayama, Y., T. Jono, Y. Koyama, N. Kura, K. Shiratama, B. Demelenne, Z. Sodnik, A. Bird, and K. Arai (2007), Observation of atmospheric influence on OICETS inter-orbit laser communication demonstrations, Proc. SPIE 6709, 67091B
- Löscher, A.: Atmospheric influence on a laser beam observed on the OICETS – ARTEMIS communication demonstration link, Atmos. Meas. Tech., 3, 1233-1239, doi:10.5194/amt-3-1233-2010, 2010.

10) Fig.8a: I do not see dashed lines.