Comments to the author: (from editor)
Although the paper has been improved a few additional details, as indicated below, require attention:
The authors would like to thank the reviewers and editor for your time and effort to help us improve the manuscript.

1. Figure 1 and its discussion do not belong in the introduction.
Answer: Thanks for your comments! We move the figure 1 and discussion of the flow chart to section 3. And add some explanation in the instruction part.

2. The uncertainty related to analog detection/APD is not as simple as using the equations derived for random errors due to shot noise in PMTs (eq.15/16). These are assumed to be a Poisson distribution, indicating that the arrival at the photodetector of photons for these signals is a Poisson stochastic process. For Poisson-distributed signals, a proportional, one-to-one relationship is known to exist between the mean of a distribution and its variance. I expect that the photocurrent from the APD no longer follows this string Poisson distribution, but there still may be a quantitative estimate of this uncertainty. In the example provided in the current manuscript, at a given altitude (say 1km) does not make physical sense to have an uncertainty that is 3-4 orders of magnitude lower for an APD than a PMT. There has to be some additional care in this and related to Fig 8. Is there a bias or electronic offset that needs to be accounted here?
Answer: We thank the reviewer for this insight on the error in this part. Technically speaking, we are following the Leblanc et al. papers that separate the uncertainty from the shot noise and the uncertainty arising from the analog-to-digital conversion, which means that our figures are still valid, but lack that specific noise uncertainty. We recalculate the detection noise according to the method mentioned in Liu 2006 et al, and figured out that the detection noise uncertainty for analog channel (as show in the new version of figure 8 (left)).

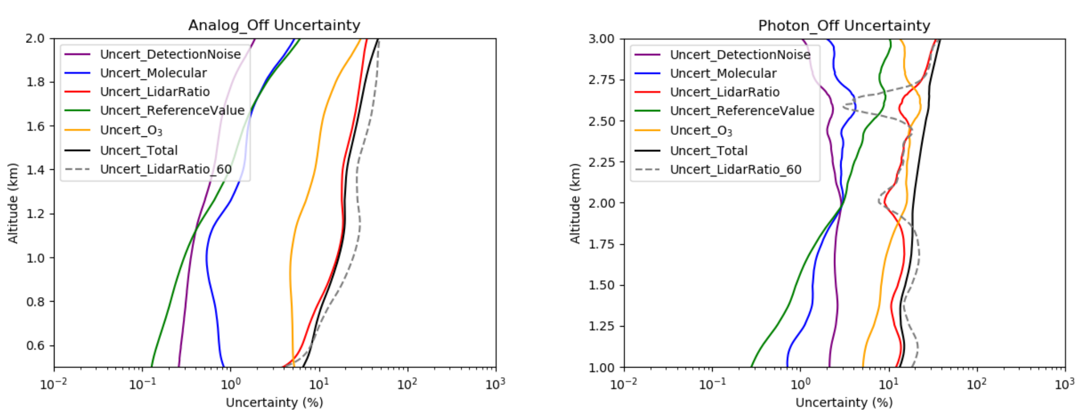

Figure 8: The uncertainty budget for the LMOL Analog channel (left) and the Photon channel (right) for August 28, 2018 afternoon retrieval. The uncertainties are attributed to different factors: detection noise (purple), molecular number density (blue), S_1 (red), reference value (green), uncertainty of O_3 (orange), total uncertainty (black). The uncertainty caused by using 60 sr as S_1 was shown in dashed gray line.

3. Is 90 sr a reasonable upper limit lidar ratio value in the UV? Please include a reference or state if confirmed by the authors own calculations.

Answer: We agree that the lidar ratio could exceed 90 sr in UV in some extreme cases. But we believe 90 sr is a reasonable upper limit lidar ratio value in our study. Prior research indicates the lidar ratio less than 90 for 532 nm for different aerosol type (Omar et al., 2009; Müller et al., 2005). And lidar ratio in UV wavelength is smaller than that in visible 532 nm for aged smoke particle (Haarig et al., 2018, Müller et al., 2005; Müller et al., 2007; Ortiz-Amezcua., 2017). This is the key reason why we believe 90 sr is a reasonable upper limit. In addition, we can see that calculation converge between 20 and 70 sr as shown in figure 4 (a). That is why we selected the current lidar ratio range (10 sr –90 sr) to save calculation time.

Reference:

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