Aggarwall et al. (AMT-2017-391) mainly employs an airborne aerosol and ozone lidar to measure air pollution from the Canadian oil sands extraction industry in northern Alberta, as well as to measure a separate fire-smoke layer over the area. The major lidar technique included in this paper is well defined and explained. The interpretation of the observation phenomenon within the industrial-polluted boundary layer as NO_x titration is adequately supported for a measurement paper and the ozone production in the layer aloft is reasonable enough. The technical aspect of properly accounting for the aerosol influence on the ozone retrieval is very useful and should be helpful for future lidar measurements in smoke plumes. The conclusions are clear and succinct.

I recommend publication following revisions.

General considerations

The authors should discuss the actinic flux field in conjunction with the discussions of transmittance, absorption, scattering, photochemical formation, etc. What was the cloud condition? Was it cloudy, hazy, humid? All of these MET variables would make a difference when considering ozone production/destruction.

Did you consider potential NOx contributions from the aircraft affecting the titration? Perhaps the altitude was always above the PBL?

My most significant concern is that this article lacks a discussion of the uncertainty budget calculation from different sources (statistical, background correction, aerosol correction, Rayleigh correction, differential ozone absorption cross section, e.g., Wang et al., 2017) for the ozone DIAL measurement. This discussion is essential.

Can you quantify or at least estimate the vertical (spatial) resolution for the ozone lidar, which is an important parameter for profiling instruments. The vertical resolution is closely related to your signal/data processing.

Specific considerations

P1, L26:

“This paper concerns the methodology and results of airborne lidar measurements of aerosol and ozone…”. However, the Introduction section does not provide any review of the instrumentation or retrieval technique of either airborne aerosol or ozone lidars.

P3, L8:

What are the conversion efficiencies and final pulse energy for the three wavelengths?

P5, L19-21:

The authors choose to retrieve ozone separately from analog and PC channels while a more common approach is to merge the analog and PC signals first at a reference counting rate (e.g. Kuang et al., 2011). So, do you then merge the ozone profiles? Can you explain more about how and where you exactly merge the ozone profile, in a constant altitude range or at a single point?

P 6.L10-11:

What is the potential error in retrieved ozone amounts from assuming consistent aerosol composition and size distribution throughout the boundary layer?

P7 L 8-11:

The author use the refractive index of kaolinite to compute the extinction and backscatter coefficients based on the studies, that kaolinite to be the prominent clay particle in the oil sands region. Here the quantitative value (e.g. fraction) for the "prominent" role would be better if provided. Do you have any evidence that the aerosols are actually Kaolinite? What is the potential error in retrieved ozone amounts if their composition (and complex refractive index) are different?

P7, L21:

"not particle size", the lidar ratio also varies with aerosol type, or refractive index, and probably humidity, not only size distribution.

P11 L21:

The GDAS meteorological dataset for HYSPLIT input has two resolution options: 1degree and 0.5degree. Which option did the authors select? For an aircraft measurement up to 150km downwind of emission, would the resolution influence the trajectory accuracy? Did the author consider other options such as NAM (12km) and HRRR (3km), perhaps?

P 19.L 1-8:

This paragraph lacks scientific analysis. The lack of supporting data such ozone precursors measurement in the fire plume to indicate the chemical production mechanism of fire ozone formation. The authors quote the paper by Jaffe and Wigder, 2012, but didn't provide any further analysis about the influence factors for ozone production (fire emissions, efficiency of combustion, photochemical reactions, aerosol effects on chemistry and radiation), meteorological patterns were mentioned without quantitative analysis.

The meaning of “the temperature would have been greater in the plumes above the fires" is not clear. This paragraph requires quantitative estimation of the environmental variables.

Minor issues

P. 1, L 17: “ground-based lidar”

P. 3, L 16: Identify PMT model(s)

Pg. 3, L 21: Why isn’t the 532 smoothing distance an integer multiple of the range bin 23=6.13*3.75?

P 6.L 15: "523nm" should be "532nm".

P6, equation (3) and (4): did you say anywhere in the context “m” represent the refractive index?

P8, L19-20: how did you calculate the extinction and backscatter profiles at “the UV wavelengths” based on the profiles at green? Did you assume a value for Angstrom exponent?

P10, L6-12: SO2 absorption cross section may significantly vary with database. Can you give the reference for the source of the SO2 absorption cross section.

P11, L15: there should be a newer reference than (Draxler and Hess, 1998) for HYSPLIT.

Kuang, S., J. F. Burris, M. J. Newchurch, S. Johnson, and S. Long (2011), Differential Absorption Lidar to measure subhourly variation of tropospheric ozone profiles, *IEEE Trans. Geosci. Remote Sens.*, *49*, 557-571, doi: 10.1109/TGRS.2010.2054834.

Wang, L., Newchurch, M. J., Alvarez II, R. J., Berkoff, T. A., Brown, S. S., Carrion, W., DeYoung R. J., Johnson, B. J., Ganoe, R., Gronoff, G., Kirgis G., Kuang, S., Langford, A. O., Leblanc T., McDuffie E. E., McGee, T. J., Pliutau, D., Senff, C. J., Sullivan, J. T., Sumnicht, G., Twigg, L. W., & Weinheimer, A. J. (2017). Quantifying TOLNet ozone lidar accuracy during the 2014 DISCOVER-AQ and FRAPPE campaigns. *Atmospheric Measurement Techniques*, 10(10), 3865-3876.