Response to Reviewer 2

This paper describes lidar observations of a Canadian forest fire smoke event over UK. It provides technical details of various types of ground-based lidars, and combines space-born observations and back-trajectory model to trace the origin of the smoke layers observed by the lidars in UK to Canadian fires. The reviewer thinks the technical description and result sections can be better balanced in two potential ways with different focuses. One way is to keep the detailed description of different instruments and add more on uncertainty estimates (something like Fig.3,4 where different atmospheric background profiles are taken, and that resulted in different layered AOD estimates. And what if modeled atmospheric background profile is taken?), and give an overview of strength and weakness of different lidars on observations of thin layers of aerosols. This would make the paper more appropriate for Atmospheric Measurement Techniques.

The instrument details have now been moved to the Supplement. See also response to Referee 1

The other way is to dig deeper on this one case study on not only the observations of smoke layers, but also the cause of multi layers and long lingering time (through analysis of the evolving meteorology, and the evolution of the smoke over the Atlantic using space-borne observations), which will really make this study interesting. This would help readers have a whole picture of this one special case. The second way, with a focus on the observation and mechanism of this special smoke event, appears more interesting to the reviewer. So the comments below follow that line.

1. Technical descriptions of the lidars are lengthy. Some basic equations and tables/figures (eg., equations 2, 3, figure 2) can be cut and text be shortened to 1/2 _2/3.

This text now moved to the supplement

2. The authors provide multiple ways to show that the origin of the smoke is Canada. However it is lengthy. For example, Fig 13, 14both present HYSPLIT results, "However examples like this proved rare" as admittedby the authors. So one of the figures is sufficient.

Agreed, fig 14 removed.

Also the SEVIRI image can be provided as supplemental material. And the CALIPSO figures can be condensed into one or two.

SEVIRI image moved to supplement. Guided by referee 1'c comments we have not reduced the CALIPSO figures.

3. The Canadian smoke evolved with a mid-latitude cyclone system during its transport over the Atlantic before it reached UK. This makes it a very interesting and special case. See the true-color imaginary from Terra for May 22, 2016

(https://worldview.earthdata.nasa.gov/?p=geographic&l=VIIRS_SNPP_CorrectedReflectance_TrueColor(hidden),MODIS_05-28&z=3&v=-144.34275416756438,-5.132810354232753,58.43849583243563,106.94531464576724). *It is worth discussing how and why the smoke evolved from one big blob (CALIOP observations) to multiple layers. The authors described a little bit about the upper level (300hPa) patterns, but it would also be desired to include some vertical cross section analysis for atmospheric states, including wind and moisture (which impacts smoke depolarization), and their evolution.*

We do not wish to expand the number of figures in this paper or to discuss in detail the processes responsible for generating the layered structure, but we have added text on pp 6, 9 and 10 drawing attention to this evolution. In fact, the OMPS figure shows very clearly how the aerosol became entrained into a cyclone, and we use this as the basis for discussion. We also refer to Dacre and Harvey's recent paper on the dispersion of atmospheric trajectories in blocking situations.

4. Page 7, line 4, It would be helpful to include typical values of delta_a for fresh smoke and aged smoke (from other studies), just for informational and comparison purpose for readers.

We now include such comparisons on p.6. Unfortunately most of the literature is for 532 and 1064 nm and there are few published measurements at 355 nm.