Author Responses to Referee 1

We would like to thank both reviewers for their significant time spent reading the manuscript and for their constructive comments for improving it. We have made very careful revisions to address all these comments. In the following paragraphs, the **bolded** words represent the reviewers' original comments and the unbolded text represents our answers.

Referee 1:

In the paper titled "EVALUATION OF UV AEROSOL RETRIEVALS FROM AN OZONE LIDAR", the authors described a new approach for retrieving aerosol properties using an ozonelidar (DIAL). The use of an ozone lidar for aerosol retrievals is rather interesting yet I have some issues with the paper, listed below, that I hope the authors can address.

Several of the parameters, including the lidar ratio and aerosol backscatter color ratio, are a strong function of aerosol type. A lidar ratio of 60 is assumed with a 20% uncertainty. The aerosol backscatter color ratio is assumed to be 1.34 with an uncertainty of ±0.11. Note that for different aerosol types, both parameters could change significantly (beyond their mentioned uncertainties). It is unsure if aerosol type could be derived from the proposed method. Without a valid method for retrieving aerosol types, generalized applications of the proposed method may be problematic. The authors should at least clearly illustrate the limitations.

AERONET data are also available from the Huntsville AERONET site. I wonder if the authors could inter-compare AERONET AODs with HSRL/ RO3QET lidar derived AODs. At least the authors should compare HSRL and AERONET AODs. The retrieved aerosol profiles are used to further refine ozone retrievals. I was wondering if the refined ozone retrievals can be further used for refining aerosol retrievals.

We have accepted the reviewer's suggestion and added a paragraph on RO_3QET data evaluation using collocated AERONET data at 340 nm (Lines 213-237 in the change-tracked version). The AOD from RO_3QET and AERONET are highly correlated, with r = 0.97. The RO_3QET AOD is on average 15% larger than the AERONET AOD due to the shorter wavelength of the lidar measurement, suggesting that the choice of *S* = 60 sr is very reasonable. For a rough estimation, the one-sigma standard deviation (9%) of the differences can be considered as the uncertainty for *S* if the variability of these differences are mostly due to the variation in *S*. (If *S* has uncertainty > 9%, we expect the one-sigma value of the differences to be larger than 9% since AERONET measures extinction and RO_3QET directly measures backscatter.) Considering that AERONET measures the column average AOD, with longer temporal integration, has its own uncertainty, and covers only 38% of the total observational period, the ±20% uncertainty of *S* for a higher vertical resolution measurement should be large enough to cover various uncertainty sources. Therefore, the additional AERONET data not only convinces us that the data quality of both instruments is good, but also confirms that the assumed *S a priori* and uncertainty are appropriate.

We agree with the reviewer that the lidar ratio changes with aerosol type and that it is hard to derive the aerosol type from elastic lidar measurements. We have provided caveats and limitations of this work in multiple places in the text. For example, in Lines 111-113, we say: **"**The *S a priori* value assumed for this study represents a mix of urban and smoke aerosols during the lidar observations (Ackermann, 1998; Burton et al., 2012; Cattrall et al., 2005; Groß et al., 2013; Müller et al., 2007). The *a priori* is application dependent." Further, in Lines 326-329 in the Conclusions section, we say: "These exponents represent a summertime average for a mixture of urban pollution and fire smoke. Speciation of aerosol types was not done in this work, although we recognize that *S* and Ångström exponent vary with the aerosol phase function and size distribution.**"**

1. Other comments Line 121, "as you go towards the" -who is "you"?

To address this issue, we have changed “decreases as you go towards the ground from the far range” to “decreases towards the ground from the far range”.

2. **Line 141, “10-min temporal average and 30-m spatial average for both HSRL”. -Should be “30-m vertical average”?**

We have replaced “spatial” with “vertical” as per suggestion.

3. **Lines 151-152, “Therefore, data contaminated by clouds is filtered out. ”-What are the cloud screening steps? Those steps need to be included.**

The cloud screening process is described at Line 89-95 in Section 2.1. We have added additional description to clarify our cloud treatment: “The cloud base height is determined by the following empirical method. Derivatives of the logarithm of the off-line analog signal are calculated for a lidar signal profile and the first range bin at which the derivative is greater than a certain threshold is considered to be the cloud base height. The threshold is chosen empirically based on the lidar SNR and the vertical resolution. Lidar data with cloud base lower than 2 km was discarded.”

4. **Lines 170-171, “The slope of the regression (2.16) results in the best” -what is “(2.16)” referring to?**

To clarify, we change this sentence to “the slope of the regression, equal to 2.16, results in …”.

5. **Line 278, equation A2, need a reference for this equation.**

We have added (Uchino et al., 1980) as the reference for Equation (A2).

6. **Line 306, equation B1, need a reference for this equation. Equations B3 and B4. Define ∆βsigA(r) and δβsigA(r).**

We have added (Taylor, 1997) as the reference for Equation (B1) a Line 374.

At Line 374, we made a change to reflect the definition of $\Delta\beta^{sig}_{A}(r)$ as: “…we obtain the uncertainty of the aerosol backscatter owing to lidar signal measurement error, $\Delta\beta^{sig}_{A}(r)$, relative to the total backscatter as…”.

The definition of $\delta\beta^{sig}_{A}(r)$ is already stated at Line 387 ahead of Equation (B3), so there is no change for that.