Separation of the optical and mass features of particle components in different aerosol mixtures by using POLIPHON retrievals in synergy with continuous polarized Micro-Pulse Lidar (P-MPL) measurements" by Carmen Córdoba-Jabonero et al., Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2018-15, 2018.

Authors' response (in blue) to the Reviewer#4's comments (in italic black):

My summary recommendation is that this paper be accepted pending Minor Revisions. I have only a few scientific concerns. Technically, there are issues with the language. I've tried to help (see attachment). In particular, pay attention to the use of colons and semi-colons. Most of the usage is redundant and/or inappropriate. Also, be mindful of paragraph structure, as it is very important in ensuring a logical and consistent flow for your reader!

Authors are grateful for the comments and suggestions of the reviewer, and mainly, for the changes related to the language as proposed in the supplement. All that will definitely improve the manuscript (see revised version).

A complete revision has been performed, and the modifications have been implemented using the Word 'Track Changes' tool in the manuscript. Nevertheless, we are sure that Copernicus copy-editing will furthermore improve language.

Figures 1, 3, 5 and 7 have been also modified in order to introduce the changes suggested by the referee.

Next, the authors' response to the specific referee's comments is addressed.

- *Are you bound by corresponding AERONET inversion retrievals, and thus a minimum AOD of ~ 0.40 in order to conduct your retrievals? If so, what is the impact of this?*

An AOD ~ 0.40 is only obtained for the dust case (intense dust scenario). For the weak dust period and the other two cases (smoke and pollen), the AOD is lower than usually during such events (disregarding single strong smoke episodes). The parameters needed for the retrieval (in general, the extinction-to-mass conversion factors) were those provided by AERONET, if available, independently on the AOD derived. We used AERONET V2 inversion Level 1.5 data for all our aerosol cases; hence, the AOD ~ 0.4 threshold limitation does not apply. We selected this AERONET data, in particular, due to the unavailability of the almucantar-derived data from V3 inversion at any level and those scarce data from V2 at Level 2.0.

Then, the text in the first version of the manuscript in **page 6, lines 197-198** has been replaced by the following one:

"AERONET V2 inversion Level 1.5 data were used for all the aerosol cases due to the unavailability of the almucantar-derived data from V3 inversion at any level and those scarce data from V2 at Level 2.0. Hence, the threshold limitation of AOD > 0.4 does not apply. Both AOD and the Ångström exponent (AEx) together with other AERONET parameters used in this work were also hourly-averaged in order to coincide with the 1-h averaging applied to P-MPL measurements."

- What at the prospects for adapting this technique operationally? This is never really discussed.

Actually, the procedure can be easily applicable in other MPLs operating within the extended MPLNET network, but also adapted to the space-borne lidars. In order to introduce this point, the following text in the **Abstract** in the first version of the manuscript (**page 2, lines 45-47**) has been added:

"In fact, this procedure can be simply implemented in other P-MPLs also operating within the world-wide Micro-Pulse Lidar Network (MPLNET), thus extending the aerosol discrimination at a global scale."

And also the text in the first version of the manuscript in **pages 18-19, lines 618-621** has been replaced by the following one:

"It should be noted that the method can be relatively easily applicable to other P-MPLs also within the world-wide NASA/Micro-Pulse Lidar Network (MPLNET), since all those systems present the same instrumental and operating configuration. Hence, the aerosol discrimination can be extended at a global scale. In addition, it can be also adapted to spaceborne lidars with an equivalent configuration (elastic with a depolarization-sensitive channel) such as the ongoing CALIOP/CALIPSO, and the forthcoming ATLID/EarthCARE (future ESA mission to be launched in 2019)."

- To my belief, and in spite of some papers in the literature, your definition of volume depolarization is not correct in the classical sense. Follow Sassen (1991) for reasoning

and historical evolution of the term. This doesn't matter, really, but you should be clear what it is that you've defined.

The **section 2.2 ('Polarized Micro-Pulse lidar (P-MPL) system')** has been modified in order to clarify this point. In particular, the **text** in the first version of the manuscript **in page 5, lines 164-177** has been replaced by the following one:

"Polarization capabilities rely on the collection of two-channel measurements (i.e., the signal measured in the so-called relative 'co-polar' and 'cross-polar' channels of the instrument, denoted as $P_{co}(z)$ and $P_{cr}(z)$ signals, respectively; see Sigma Space Corp. Manual, 2012, for more details). By adapting the methodology described in Flynn et al. (2007), the parallel and perpendicular P-MPL range-corrected signals (RCS, also called Normalized-Relative-Backscatter signals, NRB), represented as $P^{||}(z)$ and $P^{\perp}(z)$, respectively, can be expressed in terms of those P-MPL co- and cross-channel signals, $P_{co}(z)$ and $P_{cr}(z)$, respectively, as (hereafter, the dependence with height is omitted for simplicity)

$$P^{||} = P_{co} + P_{cr}, \qquad (1)$$

and

$$P^{\perp} = P_{cr} \qquad (2)$$

Then, the total RCS, P, can be expressed as

$$P = P^{||} + P^{\perp} = P_{co} + 2\,P_{cr}. \qquad (3)$$

Final corrected P, $P^{||}$ and $P^{\perp}$ are obtained using the procedure described in Campbell et al. (2002) and Welton and Campbell (2002). The linear volume depolarization ratio, δ^V, in a classical sense (Sassen, 1991), can be defined as

$$\delta^V = \frac{P^{\perp}}{P^{||}}. \qquad (4)$$

Then, the linear volume depolarization ratio δ^V for a MPL system (Flynn et al., 2007) can be easily expressed as

$$\delta^V = \frac{P_{cr}}{P_{co}+P_{cr}}. \qquad (5)"$$

These changes have affected the order of the Equations, then they have been re-numbered (also in the text).