"*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#3's comments (in italic black):

Authors thank the comments and suggestions of the reviewer that definitely will improve the manuscript (see revised version).

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

The work is of great scientific significance applicable across many fields (e.g. air chemistry, radiative transfer, health & human impact), and research method is sound. However, technical & grammatical errors were wide spread making the manuscript, at times, difficult to read. If not for these I would suggest minor revisions, but spelling, verb-tense, and phrasing errors are abound warranting major revisions.

A complete revision has been performed, and the modifications have been implemented using the Word 'Track Changes' tool in the manuscript. Furthermore, Copernicus copy-editing will certainly improve language issues in the final publication process.

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

- Further justification needs to be made for some parts. Why are the given times for the examples profiles chosen? The maximum and minimum AOD for each case along with their respective times is discussed at length, but these aren't necessarily the times in the profiles shown in figures 4, 6, and 8.

The purpose to select those specific times is to show two different atmospheric situations in terms of the vertical distribution of the optical properties (backscatter coefficients and depolarization ratios) of the aerosols for each case (dust, smoke and pollen, as shown in Figures 4, 6 and 8, respectively), and not specified by the maximal and minimal AOD values only. Therefore, for more clarity, the text has been modified (using the Word 'Track Changes' tool) in some parts of the manuscript. That is:

The text in the first version of the manuscript in **page 13, lines 414-416** has been replaced by the following one:

"In order to illustrate the vertical distribution of dust particles, **Figure 4** shows an example in terms of the profiles of both the particle backscatter coefficients (total β_p, and β_{Dc}, β_{Df} and β_{ND}, left panels) and the linear depolarization ratios (volume δ^v and particle δ_p, right panels) of both aerosol scenarios: 1) when the dust event presents a high incidence as occurred for instance at 02:00 UTC (**Fig. 4a**); and 2) after the dust particles are almost

completely removed (i.e., situation observed at 16:00 UTC, see **Fig. 4b**). These scenarios are also indicated in **Figure 3** by black arrows."

The text in the first version of the manuscript in **page 14, lines 468-470** has been replaced by the following one:

"Regarding the vertical structure, **Figure 6** shows examples of two different aerosol scenarios observed on the day: 1) a well-defined smoke layer is observed, for instance, between 6 and 7.5 km height with a certain mixing with NS aerosols at 06:00 UTC (see **Fig. 6a,** red line); and 2) the smoke signature can be detected highly mixed with NS aerosols along the atmospheric profile (i.e., situation observed at 14:00 UTC, see **Fig. 6b**). These both scenarios are also indicated in **Figure 5** by black arrows."

The text in the first version of the manuscript in **page 16, lines 525-529** has been replaced by the following one:

"In order to display the vertical distribution for this case, profiles of the particle backscatter coefficients and both the volume and particle linear depolarization ratios are shown in **Figure 8** (see legend inside). For instance, the vertical distribution is shown at 10:00 UTC, when no pollen particles are significantly detected (**Fig. 8a**), with low δ_p values close to 0.05 from surface up to around 1 km height and slightly increasing from that altitude up. This is likely due to uplifted particles. In comparison, the situation occurred later on the day (i.e., that observed at 15:00 UTC, **Fig. 8b**), the amount of pollen clearly enhances: δ_p increases, reaching higher values between 0.10 and 0.15, and pollen particles are mostly confined up to 1.5 km height from the surface. These two scenarios are also indicated in **Figure 7** by black arrows."

- Referring to diurnal variations as "First" and "second" part of the day is poor wording, and is relative. During discussion of figures 3, 5, and 7 stated times are sometimes unclear if you mean local time or UTC with wording such as "noon," which is a relative term to local time. It is also difficult to see the black AOD and Lidar Ratio symbols on the dark blue color bar in these figures. Figures 3a and 3b don't have matching x-axes.

Authors thank the suggestions of the reviewer. Hence, the manuscript has been changed (using the Word 'Track Changes' tool) as follows:

- The text has been modified regarding the revision performed for the wording of 'first/second part of the day' and 'noon' terms.
- Symbols denoting the AOD and Lidar Ratio in Figures 3, 5, and 7 have been replaced for more clarity.
- Figure 3 has been modified to match the x-axes in panels a and b.

- Why was the smoke case broken up into smoke and non-smoke, and the pollen case broken up into pollen and background aerosol? The non-smoke aerosol is said to be of

arctic origin, but there is no mention of potential local background aerosol in the retrieval, isn't this a possibility? Vice versa for the pollen case, why is there no HYSPLIT analysis for the pollen case? Is it assumed on this day the background aerosol didn't have an origin outside BCN? All this needs justification.

The arrival of smoke plumes over BCN is mostly at altitudes above the boundary layer (BL), as stated in the manuscript. Hence, the 'smoke' study was examined as a two-component case: smoke and non-smoke aerosols (likely from Arctic origin, as analyzed in the manuscript), but focused only on those tropospheric features above the boundary layer (BL), thus disregarding aerosols from other plausible local background BL sources (also stated in the manuscript). The pollen case is slightly different. The pollen particles are originating from local pollination events usually occurring close to the surface. Thus the pollen is likely mixed with aerosols supposedly coming from background, local sources. These background (BA) aerosols are supposed to be mostly composed of urban fine polluted particles, and their exact origin, whether they are local or not, is not relevant, since they do not depolarize and cannot be mistaken for highly depolarizing pollen particles.

For clarifying this aspect, the text has been modified (using the Word 'Track Changes' tool) in some parts of the manuscript, that is:

The text in the first version of the manuscript in **pages 13-14, lines 441-443** has been replaced by the following one:

"Both the particular backscatter coefficients and mass concentrations are retrieved for each component. In particular, the arrival of smoke plumes over BCN is mostly at altitudes above the boundary layer (BL); hence, this case is focused only on those tropospheric features above the BL, thus disregarding aerosols from other plausible local background BL sources."

The text in the first version of the manuscript in **page 15, lines 505-506** has been replaced by the following one:

"As for the smoke case, POL-1 retrieval is used to separate pollen (PL) particles from background (BA) aerosols. These BA are supposed to be mostly composed of urban fine polluted particles, and their exact origin, whether they are local or not, is not relevant since they do not depolarize and cannot be mistaken for highly depolarizing pollen particles. This is also the reason why HYSPLIT backtrajectories were not calculated."