*The authors would like to thank the reviewer for his/her valuable comments and suggestions. We have modified the manuscript with the proposed changes along with step by step answers to the suggestions. Please note that changes have been highlighted (in bold or 'track changes') in the manuscript and the corresponding answers to the reviewer by text below. The original comments are presented in bold letters.*

**Comment_1: The measuring period covers an almost one year of observations (from March 2018 to February 2019), with two measuring gaps during May to August and September to November, due to instrumental problems. Thus, the term "long-term observations" used by the authors, should be replaced through the manuscript with the "one year observations".**

Thank you for your comment. Indeed the challenging conditions at UAE did not allow us to have observations for the full time of the campaign. The manuscript has been updated according to the reviewer's suggestion.

**Comment_2: In the introduction part, the authors should discuss about the threshold values of the intensive optical properties (lidar ratio, depolarization ratio) used in existing typing schemes for dust particles within EARLINET for example. Stations within EARLINET, are affected mostly from the African dust, so the references clusters are attributed to properties connected with these particles. But, what about stations e.g. Cyprus, affected by both the African mineral dust and the Arabian dust. This discussion would strengthen the claim of the authors that "a universal lidar ratio for dust aerosol particles will lead to biased results".**

We have added a paragraph in the introduction discussing the lidar ratios used in EARLINET community and the CALIPSO retrievals. A few sentences were also added at the conclusion section. The additions can be also found below:

*"The lidar ratio is a parameter commonly used in lidar based aerosol typing algorithms to classify the particles within an atmospheric layer (Nicolae et al., 2018; Papagiannopoulos et al., 2018). This parameter is also critical for elastic lidar retrievals and separation techniques (e.g Giannakaki et al., 2020 and references therein). Within the European Aerosol Research Lidar Network (EARLINET, Pappalardo et al., 2014), stations are typically affected from dust outbreaks originating from the Western Saharan region. Amiridis et al. (2013) retrieved Saharan dust lidar ratios at 532 nm of 58 ± 8 sr, while a mean (range) value considering all EARLINET stations is 51 ± 10 sr (30-80 sr), at the same wavelength (Papagiannopoulos et al., 2016). Currently, a mean value of 55 sr is used for dust related applications (e.g Tesche et al 2009). On the contrary, the aerosol classification scheme from the satellite based lidar onboard CALIPSO (Vaughan et al., 2009) uses a lidar ratio for pure dust of 44 ± 9 sr (Kim et al., 2018). Nevertheless, neither approaches consider the origins of the dust which translates into different optical characteristics (African or Middle East)."*

And

*"This becomes more evident in stations where they are the receptors of both dust types and the selection of adequate dust optical parameters is important for further analysis."*

**Comment 3: In the processing part, the authors should discuss more the automatic detection of the aerosol particle layers. Do they use a minimum layer thickness threshold (Figure 3 indicates that they did not). How do they define the first detected layer. Is this the PBL top? Please explain. In the manuscript you state that "there is a very persistent and stable night-time BL at 1 km or so throughout the measurement year". Is this the first layer presented in Fig. 2.**

The aerosol layer detection uses the second derivative of the 1064 nm channel (532 nm in the absence of it and lastly 355 nm, if nothing else is available) to detect zero crossings in the signal. Because this method suffers from signal noise, we first smooth the signal and then retrieve the layer boundaries. We do use a minimum layer thickness threshold of 50 m and we also use minimum thresholds for the mean backscatter values within the aerosol layers (0.25, 0.10 and 0.05 $Mm^{-1}$ $sr^{-1}$ for the 355, 532 and 1064nm, respectively). So after the initial detection of the layers, we discard those with less than 50 m in depth and those who have low backscatter values as the statistical errors become significant. A more detailed description has been added to the corresponding section (Sect. 2.3).

The first detected layer comes from the above methodology were the base is always set to 0 m (starts from the ground) and this is the layer shown in Fig 2. It doesn't necessarily mean that the top boundary of this first layer is the PBL top (although in almost all cases it is), as the PBL is retrieved for each profile following the methodology described in Baars et al., 2008. The WCT (wavelet covariance transformation) method looks for a steep decrease in the backscattered signal at the top-height of this layer. At that point the function takes a local maximum. It is preferred for the PBL detection over the gradient method as it is less exposed to signal noise and it doesn't require vertical smoothing. Therefore, the WCT method was preferred over the gradient method for the BL top height detection. Then, the separation between BL and FT is straightforward and can be done by accounting aerosol layers falling below the BL top height (BL aerosol layers) or not (FT aerosol layers). We acknowledge here that the BL detection is not necessary the stable night-time BL layer but it often includes the residual aerosol layer from the previous day but this falls within the capabilities of any existing lidar and depends on the atmospheric conditions. Some clarification about the PBL was also added in Sect. 3.1

**Comment_4: Figure 4 and Figure 5, present inconsistent retrievals for June 2018. Figure 4 presents geometrical properties for June 2018, while Figure 5 presents missing data. Please correct the figures accordingly.**

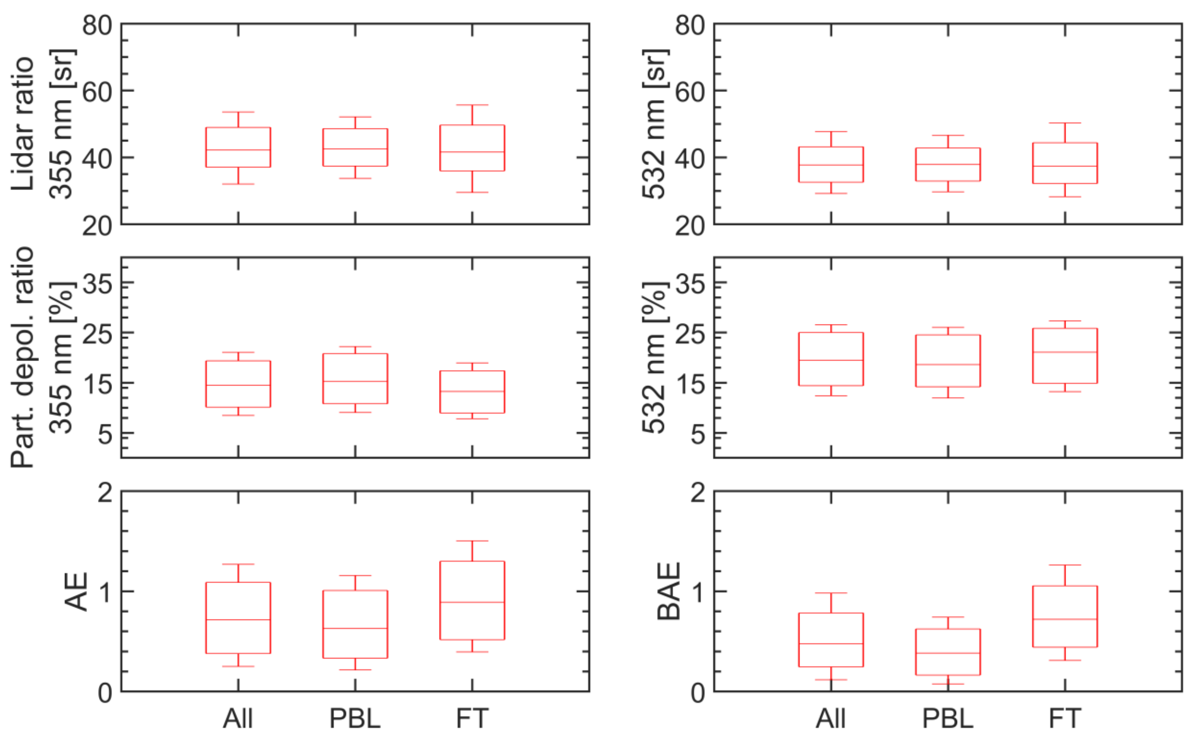
Thank you for your comment. To clear out any confusion, Figure 4 presents mean monthly values of geometrical and AOD properties including all the available retrieved aerosol profiles separated by the height (BL vs FT) while Figure 5 presents the time series of these optical properties. Therefore, the x-axis on Figure 5 presents mean values of each retrieved aerosol layer for each day. The availability of lidar measurements during June and July was limited and only at the very end of each of these two months aerosol profiles were retrieved. Note that the marking of the month in the x-axis in Fig. 5 corresponds to the first day of that month.

**Comment_5: Figure 4b, is a bit misleading. As it is shown it gives the impression that the FT has a certain depth equal to the PBL depth. Please modify.**

We have now updated the legend of Figure 4 from BL/FT to BL/FT aerosol layers.

**Comment_6: Figure 7. Maybe the authors can provide a different approach for these plots. The division of the atmosphere into 5 altitude ranges (0-1,1-2,2-3,3-4 and >5) is a bit suppressed. Maybe you could provide the information, based on the division of the atmosphere in regions, PBL, FT.**

Thank you for the suggestion. With Figure 7 we aimed to reveal height-dependent differences in the mean aerosol optical properties and further deepen our understanding of the aerosol mixtures in the region. It nicely captures the higher linear depolarization ratios at higher altitudes compared to the aerosol layers below 1 km helping us to connect properties of local dust with the rest aerosol types present. At most times dust was found as a mixture of anthropogenic pollution or marine contribution in the area considering aerosol layers below 1 km. For clarification purposes, we attach here the mean optical properties, as suggested, separated into three aerosol layer groups: all (this is the same as the inner plot in Figure 6), PBL and FT. As it can be clearly seen the behavior of the different altitudes is now smoothed and no further information can be distinguish between BL and FT aerosol optical properties. To some extent, this graph is a bit misleading showing higher Angstrom exponents and lower particle depolarization ratios for the FT category which is not necessarily true as already presented in Fig. 7 (for the lower free-troposphere).



**Comment_7: Figure 8. Authors should discuss more about the correlation of the presented properties of the Arabian dust. Can they conclude about the correlation between LR and δ? Or between the other properties?**

We have now added more discussion related to the optical properties of Arabian dust and their difference with African dust. The text has been updated considering the suggestion above (Sect.3.3).

"*Figures 8b-d also present the rest of the available aerosol layer optical properties apart from the ones defined as Arabian dust. We assume that cases with the highest linear depolarization ratios represent the pure Arabian dust optical properties since no volcanic aerosols are present over the measurement site at the given period. It is also evident form the scatter plots that the aerosol sources and types are varying thus no detailed conclusions can be made for the full data set except the ones mentioned in previous sections."*

And

*"All in all, the Arabian dust optical properties show close to 0 Ångström exponents and high linear depolarization ratios, characteristics that are similar to Saharan dust. Dissimilarly, Arabian dust has lower LRs and these LRs are almost equal at 355 nm and 532 nm. Another difference is the CRs which are well above 1 ranging from 1.1 up to 2.0 depending of the wavelength selection"*

**Comment_8: Last paragraph of 3.3. The authors discuss about the possible differences between African dust and the Arabian dust, analyzing two dust samples. However, they provide limited information about these two samples. Why are they interesting? They are linked to particular transported aerosol load? What about the lidar properties obtained during these periods of sampling? These are issues that the authors should address, so as the reader to understand the connection with the current analysis.**

We have added text accordingly. The collected samples are not linked to a particular transported aerosol load. They are normal soil samples collected from two different regions around the site. The collection was made regarding the different observed soil color and we also accounted regional discrepancies by taking samples closer and further away from the measurement site. We have added a few more sentences explaining the dust sample part in Sect 2.4 where we introduce the sampling methodology.

"*The samples were dry collected accounting both microphysical (color of the soil) and regional discrepancies; one sample was close to the observation site and the other one a few tens of kilometers away.*"

And

*"Moreover, the study of Di Biaggio et al. (2019) report that the imaginary part of the refractive index in dust samples originating from Saudi Arabia score less than that of African dust, presenting a lower absorbing efficiency compared to African dust. The difference is attributed to the content of iron oxides in the dust"*

And

*” Regarding the absorption properties of dust, it has been found that dust optical properties are more correlated to the fraction of iron oxides than the iron content itself. Nevertheless, the iron content in the collected dust samples was lower than that recorded in African dust (Di Biaggio et al. 2019).”*

**Commnet_9: Line 295. Please provide a reference to strengthen the statement.**

The references for the connection of refractive indexes and the amount of illite in the soil come in the next sentence.