Anonymous Referee 1:

We would like to thank the referee for the careful reading and the insightful suggestions. RC is the referee comment and AR is the authors response. When needed, the part of the manuscript we modified or added to the old version is reported in bold.

[Specific comments:]

RC: 1. In Figure 5(d), there are mis-alerting points above 5 km. This would be caused by the low signal-to-noise ratio. The authors should discuss about this issue in the manuscript and please consider screening the mis-alerting points, for example, by using a threshold for signal-to-noise ratios. Signal averaging would also be helpful to decrease the false detection. Although the processed data can be available every hour (or possibly 30 minutes), the time resolution seems unnecessarily too high (I could not find the resolution used in your results). The authors should explain why such high resolution compared to the updating time (every hour) is needed without improving the signal-to-noise ratio by averaging.

AR: We fully agree with the referee that the temporal resolution is unnecessarily fine. Figures 5 and 6 are given in their full resolution – i.e., 7.5 m vertical resolution and 0.5 s temporal resolution, which apparently produced false alert pixels in the case of Finokalia (Figure 5d). The poor signal-to-noise ratio above the aerosol layer is creating this artefact. Therefore, we incorporated an averaging scheme for the lidar data. To this end, we applied the methodology with 5 min and 30 m averaged lidar data. Baars et al. (2017) used, for instance, 5 min temporal resolution and 30 m of vertical resolution for a similar application and system. The updated spatial resolution of the calibrated high-resolution data and the cloud screening output is explained in Page 5 directly below Lines 7-8:

"The methodology to derive particle high-resolution data that is described in Sect. 3 is first cloud cleared and second is based on 5 min – 30 m averaged profiles in order to increase the signal-to-noise ratio."

Furthermore, we implemented a spatial smoothing filter in the EWS product in order to further reduce spurious pixels that persist after the averaging. These random and isolated pixels are screened out by averaging the pixels in a small neighbourhood, typically a 3×3 dimension. The next few lines are added in the first paragraph of Page 9:

"Furthermore, to avoid isolated false alarms in the EWS product we incorporated a linear spatial smoothing filter. It is the average of the pixels contained in the neighbourhood of each pixel, for which we defined a 3×3 pixel grid."

Figures 1 and 2 show the improved Figures 5 and 6 of the manuscript. This averaging scheme and the new figures are inserted in the new version of the submitting paper.

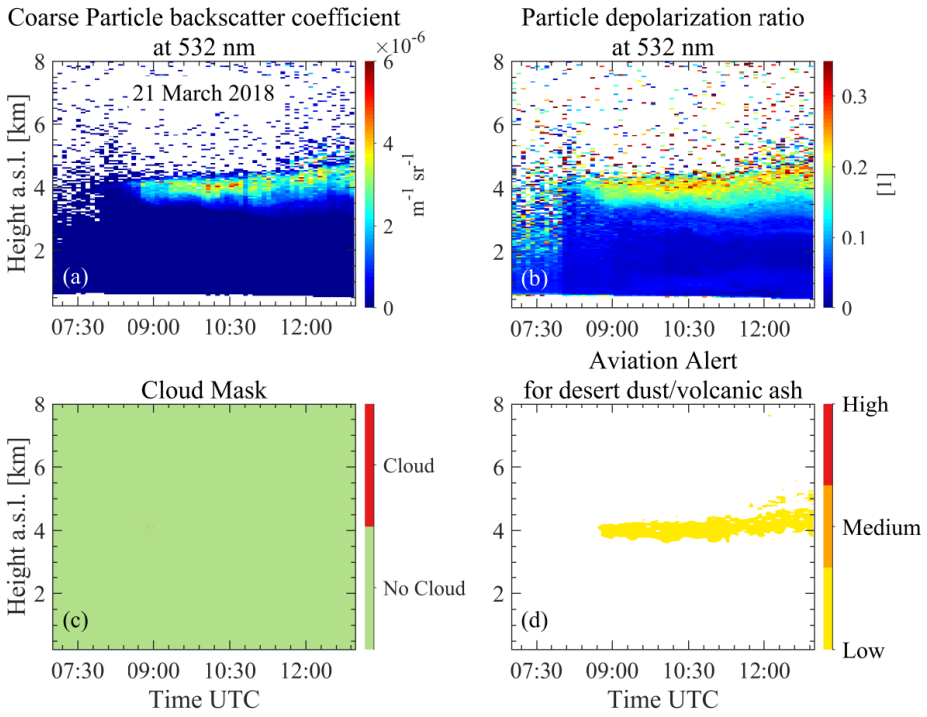

Figure 1: *EARLINET observations at Finokalia on 21 March 2018:* ***(a)*** *the coarse particle backscatter coefficient at 532 nm,* ***(b)*** *the particle depolarization ratio at 532 nm,* ***(c)*** *the cloud screening output, and* ***(d)*** *the alert for aviation. Note that the cloud screening product is given in its full resolution – i.e., the vertical resolution is 7.5 m and the temporal resolution is 30 s – all the other products have resolution of 30 m and 5 min instead.*

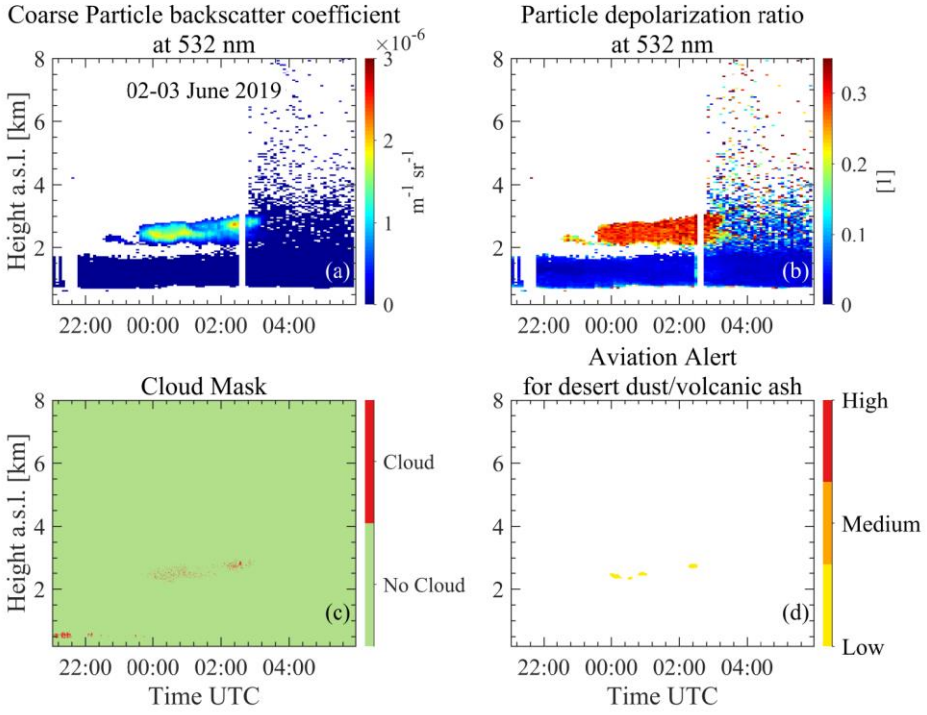

Figure 2: *EARLINET observations at Antikythera on 2–3 June 2019.* ***(a)*** *the coarse particle backscatter coefficient at 532 nm,* ***(b)*** *the particle depolarization ratio at 532 nm,* ***(c)*** *the cloud screening output, and* ***(d)*** *the alert for aviation. Note that the cloud screening product is given in its full resolution – i.e., the vertical resolution is 7.5 m and the temporal resolution is 30 s – all the other products have resolution of 30 m and 5 min instead.*

RC: 2. In the second case of your results (observations at Antikythera), the authors mentioned that "few pixels within the same aerosol layer are wrongly classified as clouds". In Figure 6(d), are the cloudy pixels excluded from the aviation alert? Please clarify it because, if the cloudy pixels are not excluded, your system can easily misclassify cirrus clouds as dust.

AR: The referee is right as the whole methodology relies on the correct identification of cloudy pixels. Unfortunately, not clearly stated in the text, we kept the cloudy pixels in the aerosol layer that reside in the range 2-3 km, while the cloudy pixels in the lower part of the timeseries have been removed. In Section 2 we outlined that the cloud screening still suffers from false detection and for the cases shown in the submitted paper we manually examined the cloud mask and removed cloudy pixels when we considered necessary. The sentence in Page 10 Lines 18-19 is rephrased and now reads:

"It is noteworthy that, as seen in the cloud mask, few pixels within the same aerosol layer are wrongly classified as clouds and are nonetheless used in the alert delivery".

RC: In the last paragraph of the section 4.2, the authors mentioned that "In synthesis, both observations and model simulations advocate for the co-existence of volcanic dust and aged desert dust particles in the aerosol scene", but I could not understand this sentence, because, in the simulation results, volcanic ash dust did not appear below 2 km and desert dust particles are few above 2 km. Therefore, I supposed the volcanic ash dust and desert dust are not "co-existence" in the same layer. I believe these events happened at the same time, but the word "co-existence" may be misleading.

AR: We are sorry for the confusing statement. We wanted to stress the probable identification in the same aerosol scene of desert dust and volcanic dust in separate layers. Therefore, we modified the sentence as follows:

"In synthesis, both observations and model simulations advocate for the identification of likely volcanic dust and aged desert dust particles in the same aerosol scene but in separate layers".

RC: In Table 2, I understand that EWS was not available for the stations indicated by (*) because they could not provide depolarization channel during the exercise, but why it was not available for the other stations, for example Belgrade (SRB), even though the measurement performed percent was 100 %. The authors should mention the reason.

AR: We thank the referee for the opportunity to clarify that we were able to deliver the tailored product whenever possible. However, the EWS delivers no warning for aerosol free conditions and spherical particles layers – i.e., local pollution for most of the cases, therefore we chose not to show any results in the submitting manuscript. Moreover, we think that the examined cases (Antikythera and Finokalia) provide the concept of the methodology and showcase the performance in case of the above-mentioned conditions. The next sentence is inserted in Page 11 Line 13:

"Hence, results of the exercise are not shown here, nonetheless the EARLINET observations are available through the EARLINET Quicklook Interface."

Regarding the Belgrade station, there is a mistake as this EARLINET station has no depolarization channel. The table is updated, and the error corrected.

In the following, we show an example of the EWS during the exercise. Figure 3 illustrates the measurements from the Barcelona EARLINET site on 5 March from 14:00 UTC to 15:00 UTC, where a thin depolarizing layer resides slightly over the planetary boundary layer. The EWS produced no warning as the criteria were not met.

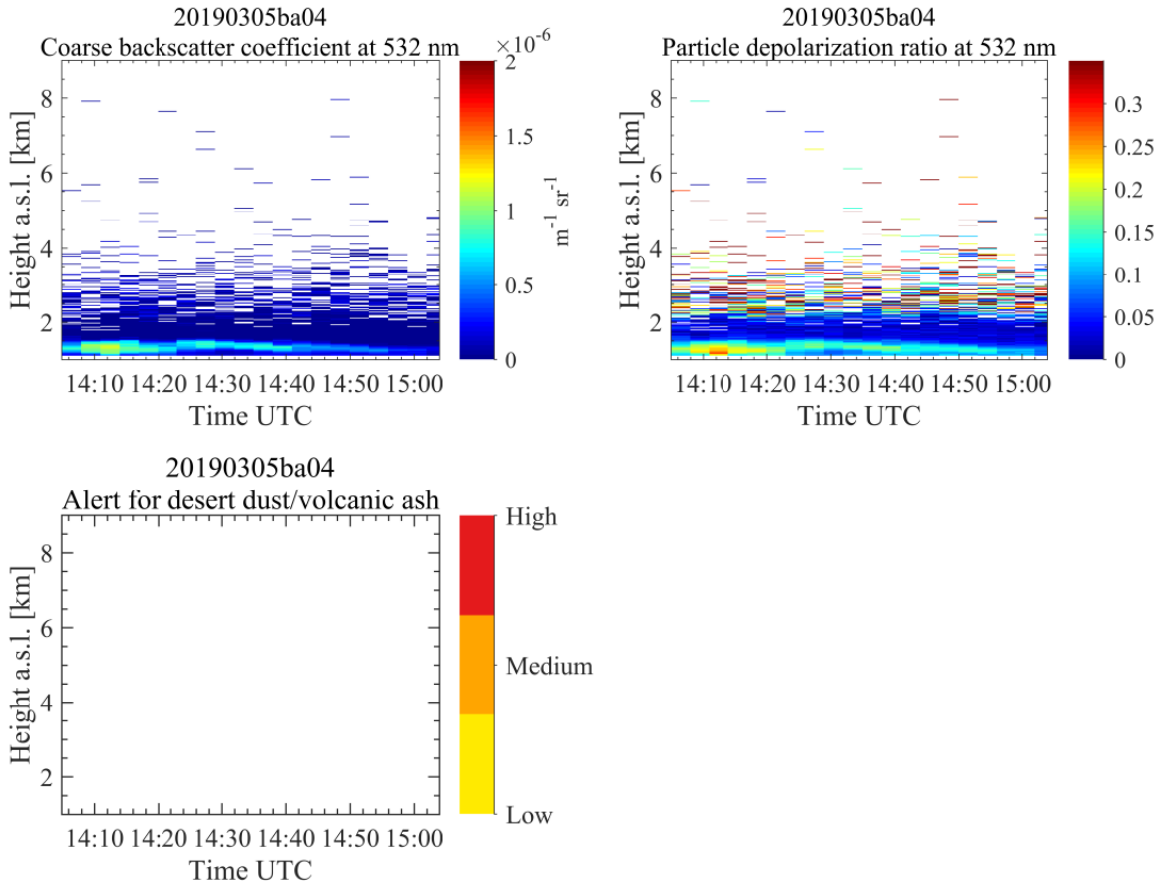

Figure 3: *EARLINET observations at Barcelona on 5 March 2019.* ***(up left)*** *the coarse particle backscatter coefficient at 532 nm,* ***(up right)*** *the particle depolarization ratio at 532 nm, and* ***(down left)*** *the alert for aviation.*

RC: In Figure 9, the time domain is not same as Figure 6, so that comparison with the observation was not easy. Please consider changing the time domain or indicating observation time domain by e.g., dashed lines.

AR: Thank you. The figure now reports red lines that correspond to the time domain of the lidar observations. The figure is given below.

[Technical corrections]

RC: Page 3 line 23, “The latter and can be expressed as”: “and” should be removed? Please confirm it.

AR: Thank you. This is a typo and it is corrected.

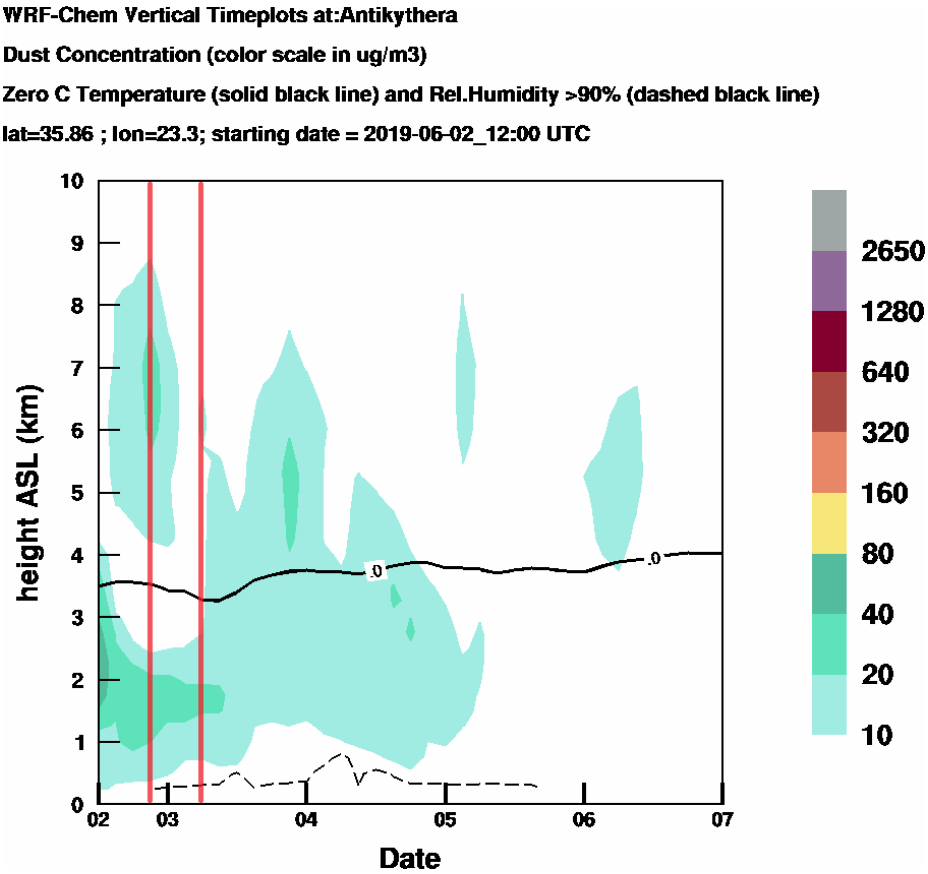

Figure 4: *WRF-Chem time-height cross section of simulated dust concentration (μg/m^3) over Antikythera starting at 2 June 12:00 UTC. The solid black line is the 0 °C isotherm and the dashed black line indicates 90% relative humidity. The red lines correspond to time domain of the lidar observations – i.e., starting 21:00 UTC on 2 June 2019 until 06:00 UTC on 3 June 2019.*