Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-865-RC3, 2020

Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Aerosol type classification analysis using EARLINET multiwavelength and depolarization lidar observations" *by* Maria Mylonaki et al.

Anonymous Referee #3

Received and published: 26 November 2020

General

The authors present SCAN, a new classification algorithm that relies on aerosol geometrical properties from lidar measurements and the Lagrangian trajectory model HYSPLIT. They compare their algorithm with well tested aerosol classification approaches (Mahalanobis Distance, Neural Network) that are based on the aerosol intensive optical properties. The subject is interesting as this algorithm shows that, while manual classification with trajectory is a rather common approach, automated classification is also possible using geometrical aerosol information that most aerosol oriented lidar systems (and maybe even Ceilometers) can provide. Therefore, I recommend this manuscript

for publication in ACP after some minor revisions/improvements are performed.

Comments

– Section 2.1 (Source classification analysis): An altitude threshold of the trajectory is applied per domain in order for the algorithm to decide whether emitted particles could be carried away. The time the air mass remains below this altitude limit is crucial though. Is it meaningful to also include such an additional threshold in the algorithm?

– Section 2.1 (Source classification analysis): Is a single hot spot sufficient to mark a layer as smoke mixture? The authors could fine tune this limit (number of hot spots near the trajectory within a polluted/clean continental box" looking at the performance of SCAN in comparison with the other two algorithms

– Section 2.1 (Source classification analysis): The authors should add a few lines here to explain the link between the aerosol type and the 4 kinds of domains. While this is straightforward for marine and dust types, this is not the case for the continental polluted aerosols. The polluted continental domain on the map probably correspond to regions with increased urban activity but this has to be specified in the manuscript.

– Section 2.1 (Neural network aerosol classification algorithm): Have the authors checked the performance of NATALI by applying different user configurations? Pieces of information such as the selected confidence level and minimum agreement threshold should be provided here.

– Section 2.3 (Case studies): A lot of numbers are provided in this part which makes it hard to follow. It would be more efficient if they were presented in tables.

– Line 111: Please specify also the accumulated probability that corresponds to a MD of 4.3 with 4 degree of freedom (independent variables). In addition, the authors explain why these thresholds are applied. Are they supported by previous studies?

– Line 168: This technique is also applied in NATALI. Is the layering automatically performed by SCAN or is the analysis based on layers obtained by NATALI? In the latter case, it has to be specified in the manuscript (e.g. “Source classification analysis” Section) that only the classification part of SCAN is automated, and not the layering part.

– Lines 224-251: Care has to be taken here because the Mahalanobis distance algorithm utilizes both two different probability metrics, the chi-squared probability (Mahalanobis Distance) and also the normalized probability. Which one are the authors referring to?

Minor Corrections

– Line 28: "...while MD has the percentage of..." Do the authors mean highest percentage?

– Line 55: Please correct the typo "neither objective nor automated"

– Line 117: Please replace "3+2" with "3b_$\lambda\alpha$+2a_$\lambda\alpha$"

– Figure 3: I suggest that the authors use different colors for the layer base and top. Otherwise the layer boundaries can be confusing for the Extinction and Backscatter profiles.

– Line 423: "dust and dust aerosols mixtures" Is this a typo?

– Figure 5: Please check the percentages of pie charts of Figure 5 as the do not sum up to exactly 100%.

– Figure 6: Please check the percentages of pie charts of Figure 6 as the do not sum up to exactly 100%.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-865, 2020.