I would like to thank the editor for his valuable feedback. It is particularly appreciated given his expertise and involvement in scientific work related to the subject of this article. My responses to his comments are provided in bold below.

Editor comments on the revised version

Thank you for responding to the referees' comments and revising the manuscript accordingly. Having studied your revisions, I would like to ask you to consider the following comments before the paper can be accepted for publication.

1. The new introduction provides more context on aerosol typing, which is helpful. However, several statements remain rather vague, and references are missing. Please discuss existing approaches to aerosol typing and provide the relevant references, particularly for the CALIPSO and EarthCARE classification schemes which are mentioned in the text.

The references have been included in the introduction, along with a description of the methods used (see the marked-up manuscript version).

2. In Sect. 4.2.1, please update the review of literature values and include recent references. For instance, a database of LR and PDR values at 355 nm has been provided by Floutsi et al. (2023a, b).

These data indeed significantly supplement the assessments carried out elsewhere. The reference has therefore been added to Section 4.2.1.
"Figure 2 in Floutsi et al. (2023) clearly shows the overlap between the different aerosol classes in the LR and PDR ranges at 355 nm, as well as the potential for distinguishing them from one another."

3. Several other aerosol classification schemes use four basic components instead of three as proposed here (e.g., Holzer-Popp et al., 2013; Nishizawa et al., 2017; Wandinger et al.; Floutsi et al., 2024). Please contextualize your approach within the existing literature and discuss the pros and cons of the different methods.

These classification methods were added to the introduction following comment 1.
A discussion regarding the merits of this method compared with the one used for ATLID has been added at the end of section 4.2.1.
"Unlike the approaches proposed by Wandinger et al. (2023) and Floutsi et al. (2024), which require initial conditions and prior estimates of the variance–covariance matrices of both the observables and the lidar simulator, the method used here does not rely on an optimal estimation approach. It is therefore simpler to implement. Furthermore, it is based on ground-based measurements, for which the signal-to-noise ratio is significantly higher than that of spaceborne measurements such as those performed by ATLID. In the latter case, the implementation of an optimal estimation approach may be more appropriate, as it enables smoothing of the retrieved information."

Optimal estimation methods, which are in fact based on Bayesian techniques, are well suited to data assimilation approaches (e.g. Kalman filters). They have also been widely used, and continue to be used, to retrieve, for example, water vapour or temperature profiles from instruments such as IASI. Although these methods generally produce good results, they remain highly dependent on the chosen initial conditions. These conditions can be defined more accurately when representative reference datasets are available.
To illustrate this point, the retrieval of temperature profiles requires classifications based on extensive radiosonde datasets that clearly account for seasonal and latitudinal variability. In my opinion, we do not yet have sufficiently comprehensive datasets combining lidar ratio (LR) and particle depolarization ratios (PDRs) to achieve a comparable level of robustness for aerosol classification.
I do not discuss this aspect in the present article, as it falls outside its main scope. Nevertheless, I am fully aware that radiosonde observations are easier and less expensive to perform than lidar measurements, which remain relatively sparse. Efforts are currently being made to improve the situation through initiatives such as ACTRIS-EU, although the available resources still vary considerably from one country to another.

4. Please check the scaling of the color bars in your figures and avoid strange values with two decimal places (cf. RH in Fig. 4, PDR in Fig. 5).

The correction has been done.

5. Please ensure that your equations are consistent with the submission guidelines (https://www.atmospheric-measurement-techniques.net/submission.html Mathematical notation and terminology). Variables should be indicated using a mathematical symbol rather than an abbreviation (e.g. □ instead of *AOT* or □ instead of *PDR*). Please follow the rules for the use of italic and roman fonts.

The correction has been done.

6. Data availability: This statement is thought to provide information on the accessibility of data presented and discussed in the paper, e.g., the FENNEC data set. Please consult the submission guidelines under the topic “Prepare your assets” and provide information accordingly.

The original data were archived in a database maintained by the CNRS (the French National Centre for Scientific Research). We do not have access to such a database within my organisation, which operates in the nuclear sector, for obvious security reasons. However, the results presented in this article are available from the author upon reasonable request, as they do not contain any sensitive information. This point has now been added to the manuscript, as it may be useful for future users.