Answer to referee 1

General comments

The work by Torres et al. aims to demonstrate the feasibility of fully automated sun-photometer measurements aboard ships that meet AERONET standards, ensuring that shipborne data is consistent with existing land-based AERONET observations. This advancement supports the development of a shipborne AERONET-compatible network, addressing current observational gaps in aerosol measurements over remote maritime regions, enabling reliable assessments of aerosol optical depth measurements and other aerosol-related properties. The study details the adaptation of the CIMEL CE318-T Sun photometer for shipborne autonomous operation, and analyses data collected over a three-year period in the southwestern Indian Ocean aboard R.V. Marion Dufresne. The aerosol optical depth is validated through intercomparisons with co-located instruments and the nearby Saint-Denis AERONET site, and the first shipborne quality-assured AERONET aerosol retrievals are presented.

We thank Referee 1 for their thorough and constructive review of our manuscript, as well as for the positive evaluation of its scientific significance and suitability for publication in Atmospheric Measurement Techniques. We appreciate the opportunity to address the comments, which have helped us to improve the clarity and structure of the manuscript. Below we provide detailed responses to each point, with changes implemented in the revised version of the manuscript.

The manuscript is quite dense, with a large amount of background information provided in the early sections. While this provides useful context, it would benefit from streamlining and improved organization to enhance clarity and readability.

We agree with this observation and have streamlined the Introduction to enhance clarity. In particular, we have moved the historical narrative describing the development of the sea-adapted CE318-T photometer from the end of the Introduction to the beginning of Section 2.1, where it more logically belongs. This allows the Introduction to focus more directly on the scientific context and motivation of the study, while improving the overall readability.

Additionally, I suggest including a systematic cost-benefit analysis (space and power requirements, maintenance demands, personnel needs, etc.) and explicitly address the operational feasibility of broader deployment, useful to assess scalability.

We thank the reviewer for this constructive suggestion. While a formal cost-benefit analysis remains beyond the scope of the present study, we have included a detailed paragraph addressing the system's operational feasibility in Section 2.1.2, "Current version and implementation". This addition discusses key aspects relevant to scalability, including space and power requirements, autonomous operation, minimal maintenance and personnel needs, and practical considerations for shipboard installation. We believe this information is best situated within the technical description of the instrument and its deployment, where it naturally complements the system overview.

Overall, I consider the study to be scientifically significant and well-aligned with the scope and objectives of Atmospheric Measurement Techniques (AMT), therefore I recommend publication after minor revisions.

Specific comments

The introduction is generally well-written, effectively establishing the scientific context and motivation for the study. However, it presents a lot of foundational information before transitioning to the study's focus. A more direct introduction to the specific objectives of the research would make the introduction more engaging and accessible to a broader audience. For example, the detailed discussion of system configurations and preliminary tests aboard various research vessels, while informative, could be more effectively integrated later in the manuscript. Consider summarizing this content in the introduction and relocating the technical details to either subsequent sections or a new dedicated section. Also, the final part of the introduction could benefit from a more explicit presentation of the research objectives.

We thank the reviewer for this helpful observation. This comment has also been raised by the other referees and the editor. In response, we have revised the structure of the manuscript to better reflect this recommendation. The detailed narrative on the system's development and early tests has been removed from the Introduction and is now presented in a dedicated subsection (Section 2.1.1, "System adaptation and historical development"), where it naturally follows the technical context of the study. In the Introduction, this content has been reduced to a brief summary, which improves the focus and flow of the section.

Furthermore, the final part of the Introduction has been rewritten to more clearly and explicitly present the main objectives of the study, highlighting the scientific goals and the relevance of shipborne AERONET-compatible measurements. We believe these changes enhance the readability and accessibility of the manuscript while preserving the necessary technical context.

In section 2.2, I suggest improving the structure by breaking it down into clearer subsections corresponding to key stages (e.g., calibration, cloud screening, and quality control) to enhance readability. Additionally, consider reducing redundancy, as some of the information presented in section 2, overlaps with content in the Introduction.

We thank the reviewer for this helpful suggestion. In response, we have restructured Section 2.2 under the title "Data Processing and Availability", introducing five dedicated subsubsections that reflect the key stages of the data workflow:

- 2.2.1. Acquisition, calibration and treatment
- 2.2.2. Correct functioning and Level~1.0 assignment
- 2.2.3. Cloud screening and Level~1.5 assignment
- 2.2.4. Sky radiances and inversion
- 2.2.5. Availability

This revised organization improves the overall logic and readability of the section by aligning with the natural sequence of data acquisition, processing, and dissemination. Additionally, some paragraphs have been relocated or slightly condensed to avoid redundancy with the Introduction and to enhance narrative flow. We believe this structure makes the content more accessible to the reader while preserving all essential technical details.

In Section 3.1, the AOD averages presented appear to correspond to the complete dataset of valid measurements. In Section 3.2, it is stated that from April to June 2023, the R.V. Marion Dufresne was operating along the Brazilian coast. Were these data included in the averages shown in Tables 1 and 2? If so, the discussion regarding comparisons of average AOD conditions over the Indian Ocean with other studies should be revised, or the averages in the tables recalculated to exclude these data. Additionally, were there any other periods during the campaign when the vessel operated in regions outside the Indian Ocean? Please clarify this.

We thank the referee for raising this important point. Indeed, the averages presented in Tables 1 and 2 were computed from the full dataset of valid AOD measurements collected aboard the R.V. Marion Dufresne between July 2021 and June 2024. This includes a short period (April–June 2023) during the Amaryllis-Amagas and Transama campaigns, when the vessel was relocated from its usual operational area in the southwestern Indian Ocean to the Brazilian coast and back.

However, this segment represents less than 5 % of the total dataset, and no photometer data were collected near the Brazilian coast due to a lack of authorization from the local authorities. Therefore, the available data for that period correspond exclusively to the transit across the South Atlantic between La Réunion and Brazil and back, preserving the consistency of observations within a remote marine environment. Moreover, we recalculated the averaged values using only the measurements from the Transama transit campaign (AOD_{440}= 0.08 and Ångström exponent = 0.06), and found them to be very similar to the global averages. This confirms their representativeness and minimal influence on the overall results.

Nevertheless, we have added an explicit clarification in Section 3.1 to avoid any ambiguity in the interpretation of the spatial coverage of the dataset.

Section 3.2 could benefit from further use of subsections. For instance, it could be subdivided into parts that separately present the instrument consistency analysis (intercomparison between sun photometers #1273 and #1243) and the comparison with the Saint-Denis AERONET site.

We thank the reviewer for this constructive suggestion. Following the recommendation, Section 3.2 has been subdivided into two subsubsections to clearly separate the two types of validation presented. The first, entitled *"3.2.1 Validation during Transama campaign"*, focuses on the intercomparison between the two shipborne photometers (#1273 and #1243) during the Transama campaign. The second, entitled *"3.2.2 Validation against AERONET Saint-Denis observations"*, presents the comparison between shipborne AOD measurements and those obtained at the ground-based AERONET site in Saint-Denis. This restructuring improves the clarity and readability of the section.

The systematic cost-benefit analysis mentioned above could be included in section 5. Additionally, detailing the unique challenges associated with shipborne sun-photometer measurements in maritime environments would enhance this section.

As mentioned in our response above, a brief evaluation of operational feasibility and scalability has been included in Section 2.1.2, "Current version and implementation", where the system is technically described and its real-world deployment is addressed. We consider this a more suitable location for such content, as it directly relates to the physical characteristics and practical use of the instrument. In contrast, we prefer to reserve the Discussion section for scientific and methodological aspects with implications for data interpretation or broader measurement strategies.

Technical corrections

- Lines 164 to 168: there's some problem with the text here, please check and correct.

Thank you for pointing this out. We believe this issue resulted from a text rendering problem during the PDF conversion process. In the version we downloaded from AMT, this section displays correctly. We expect the issue to be resolved in the revised version.

- The Ångström exponent is mentioned several times, but the wavelength range used for its calculation is not clearly stated. I infer that it is 440–870 nm, as in the MAN dataset, but this should be explicitly specified in the manuscript. Consider including this information also in Tables 1 and 2, in the same way the AOD wavelengths are indicated.

We thank the reviewer for pointing this out. The wavelength range used for the Ångström Exponent calculation is now explicitly stated in Section 2.2.1, where the data processing procedures are described. Specifically, we indicate that the 440–870 nm range is used throughout this study, as infered by the referee since it is the most commonly adopted range in the AERONET literature and widely used in related studies, including the MAN dataset. Since this definition is consistently applied across the manuscript, we do not include the wavelength range as a subscript (e.g. $\alpha_{440-870}$) in each occurrence, to avoid redundancy.