

Overall assessment

The manuscript presents a valuable multi-instrument case study of biomass-burning aerosol transport over Réunion Island. The observations are of high quality and the dataset is suitable for ACP. My concerns primarily relate to the strength of the scientific inference rather than the measurements. Several conclusions are stronger than the evidence currently supports, particularly where model output is interpreted as confirmation rather than supporting evidence.

Major comments

1. Objectives not achieved (pp. 3–4, lines 95–101)

The manuscript states that the study aims to reduce uncertainties in aerosol radiative forcing assessments using a multi-instrument approach. No radiative forcing calculations or quantitative uncertainty reduction are presented. Please revise the objective or demonstrate how uncertainty is reduced.

2. Circular reasoning in the analysis chain (p. 8, lines 224–236; pp. 9–10, lines 255–267)

The workflow explicitly states that agreement between AERONET and CAMS is used before interpreting CAMS aerosol composition. Validation of total AOD cannot be considered validation of aerosol speciation. This logical limitation should be acknowledged.

3. Observation versus inference (pp. 10–15)

Throughout Sections 3.2–3.4, direct observations, retrieved quantities, model output and interpretation are interwoven. Please explicitly distinguish observations (AERONET, lidar, FTIR, CALIOP), retrievals, simulations (CAMS/FLEXPART) and scientific inference.

4. Source attribution remains model dependent (Abstract lines 26–32; pp. 10–15)

Statements attributing individual layers to Southern Africa or South America are primarily supported by FLEXPART. Please consistently state that these are model-supported interpretations rather than direct observational demonstrations.

5. Representativeness (p. 9, lines 249–252; p. 5, lines 137–139)

The manuscript analyses only two lidar nights because the system operates twice weekly. Please discuss whether these cases are representative of the September episode and avoid broader generalization where unsupported.

6. Alternative hypotheses (Discussion and Conclusions)

The manuscript rarely evaluates competing explanations (transport timing, hygroscopicity, aerosol mixing state, injection-height uncertainty). Explicit discussion would strengthen the scientific argument.

Specific page-by-page comments

- **Page 1, Abstract (lines 20–32):** The phrase 'for the first time' should be qualified. Please clarify whether this refers specifically to high-resolution observations over Réunion rather than biomass-burning plume characterization in general.
- **Page 2 (lines 49–77):** The literature review is comprehensive but the remaining knowledge gap after SAFARI, AEROCLO-sA, BiBAC and Flamant et al. should be stated more explicitly.
- **Page 3 (lines 95–101):** The objective regarding reduction of radiative forcing uncertainty is not addressed quantitatively later in the manuscript.
- **Page 4 (lines 112–114):** Please briefly discuss uncertainty introduced by converting AOD500 to AOD550.
- **Page 5 (lines 144–150):** Please clarify which assumptions dominate uncertainty in the Klett retrieval and whether retrieval sensitivity was evaluated.
- **Page 6 (lines 171–180):** The discussion of FTIR uncertainties is appreciated. Consider explaining whether smoothing by the averaging kernel influences the comparison with FLEXPART.
- **Page 7 (lines 205–220):** Please discuss uncertainty associated with GFAS emissions, plume injection heights and ERA5 meteorology, as these directly affect source attribution.
- **Page 8 (lines 224–236):** The sequential workflow is useful but currently encourages a circular interpretation. Please distinguish validation from interpretation.
- **Page 9 (lines 255–260):** Please report RMSE, bias and sample size in addition to Spearman correlation.
- **Page 10 (lines 262–267):** Organic matter dominance is model-derived. Please remind readers this is not an observational result.
- **Page 10 (lines 276–285):** The description of two 'rivers of smoke' is plausible but remains qualitative. Please define the identification criteria or clarify that the terminology is descriptive.
- **Page 12 (lines 294–300):** CALIOP aerosol typing has known classification uncertainties. Please discuss whether these affect the interpretation.
- **Page 13 (lines 318–321):** The interpretation of Ångström exponent would benefit from acknowledging that humidity, mixing state and combustion conditions may also influence particle size.
- **Page 14 (lines 334–339):** Using a lidar ratio derived from one plume for multiple retrievals is reasonable but the manuscript should discuss sensitivity of the results to this assumption.
- **Page 15 (lines 347–354):** Given the reported WVMR uncertainty (~74%), the interpretation of moisture differences should remain appropriately cautious.
- **Discussion:** Include a subsection explicitly distinguishing demonstrated findings from model-supported interpretations.
- **Conclusions:** Restrict conclusions to what is directly demonstrated by the data and avoid implying definitive source attribution where uncertainty remains