

General comments:

This manuscript presents a valuable assessment of future aerosol emission projections for sub-Saharan Africa, highlighting the considerable diversity among scenarios and their implications for air pollution, health, and climate in the future. Overall, the manuscript is well-structured and presents interesting and much-needed results that contribute to understanding future emissions in Africa and their potential health impacts.

However, there are several areas that could be improved. The introduction feels somewhat disjointed, and although one of the main focuses of the article is the impact of air pollution on health, this topic is only briefly addressed. My primary recommendation is to expand on this aspect within the introduction and improve the overall narrative flow.

In addition, certain methodological details could benefit from further clarification. For example, in Section 2.2, where all scenarios are defined, it is at times difficult to follow which and how many scenarios are actually used. Moreover, the rationale behind the selection of scenarios should be better justified.

Some figures also lack sufficient quality—Figures 3 and 4 in particular would benefit from improved resolution and clarity.

Finally, although the manuscript acknowledges uncertainties in emission inventories, providing more detail on how these uncertainties might influence the main conclusions would offer a clearer perspective on the robustness of the findings.

Addressing these points would significantly enhance the clarity and impact of the manuscript. These comments, along with minor technical corrections, are detailed in the specific and technical comments below. Overall, this study makes a strong contribution to the field and, with some adjustments, will serve as a valuable resource for future research and policy discussions.

Specific comments:**Introduction:**

As mentioned previously, the introduction appears somewhat brief and simplistic. It could benefit from improved coherence and a more fluid narrative. Moreover, it lacks sufficient information on the health impacts of air pollution, which is one of the central pillars of this study. Strengthening the connection between changes in air pollution and their health impacts would enhance the cohesion and relevance of the introduction.

Additionally, the manuscript could better clarify why this study is necessary in comparison to previous research. What are the specific knowledge gaps this study aims to address?

2. Methods:

2.1 Study Domain:

There is insufficient justification for the chosen study domain. For instance:

- **Justification for regional division:** Why were these five specific subregions selected, and how do they influence the analysis?
- **WHO region adjustments:** A brief explanation of why modifications to WHO regions were made and what those adjustments entailed would be helpful.
- **Definition of boundaries:** How were the boundaries for each subregion determined—based on geographic coordinates, political borders, or climatic characteristics?
- **References and support:** Including additional references that support the chosen classification or that have used similar regional divisions in previous studies would strengthen this section.

2.2 Emissions:

This section contains a lot of information on the scenarios and their characteristics. Including a summary table—perhaps in the supplementary material—would help clarify which scenarios are considered. At present, it can be difficult to grasp how many scenarios are used, what they are, and how they differ from each other.

Several scenario frameworks are presented (SSP, ECLIPSE, UNEP), but it is not clearly explained why these particular scenarios were chosen. Why these ten, and not others? A brief justification for the selection of these specific scenarios over other potential alternatives would be valuable.

Consistency in reference years: The period 2015–2018 is mentioned as the baseline, yet 2016 is used for ECLIPSE and 2018 for UNEP. What accounts for this variation? Clarification would improve the consistency of the methodology.

2.3 OsloCTM3

Model Simulations and Resolution: The OsloCTM3 model operates at a horizontal resolution of $2.25^\circ \times 2.25^\circ$. Is this resolution not rather coarse for capturing spatial details at the regional level? A brief explanation of the advantages or limitations of the OsloCTM3 compared to other chemical transport models would be helpful.

Explanation of resolution and rescaling: The manuscript mentions that the model runs at $2.25^\circ \times 2.25^\circ$ resolution, but the data are then rescaled to $1^\circ \times 1^\circ$. It would be useful to briefly explain why this rescaling is performed and what impact it may have on the accuracy of the results.

2.4 Observations

Justification for the selection of observational data: The manuscript states that PM2.5 observations are obtained from U.S. embassies in Africa. Is there a specific reason for selecting only these data instead of including other monitoring networks? Clarifying this point would help assess whether this selection introduces any limitations regarding the spatial representativeness of the observational dataset.

2.5 Health Impact Assessment

Spatial resolution: Data are interpolated to a 25×25 km resolution, but final population estimates are provided at 5×5 km resolution. Could this discrepancy introduce biases in the estimates of excess mortality?

Results

Figures 7, S9, and S10 are not cited in the text. Please, add them.

As mentioned earlier, figure clarity should be improved, particularly for Figures 3 and 4. Additionally, in the health-related section, the manuscript does not discuss the relative effect of aging versus overall population growth, an important consideration for interpreting the results.

MINOR COMMENTS:

Terminology consistency:

- In some parts of the manuscript, the term “*future emissions*” is used, while in others “*2050 emissions*” appears. For greater clarity, it would be helpful to adopt consistent terminology throughout the manuscript.
- Similarly, there is inconsistency in referring to the baseline emissions as “*baseline emissions*” versus “*historical emissions*”. Please ensure consistent use of these terms across the text.
- **Cross-referencing between sections:** In the section where the model validation against observations in Africa is discussed, it would be helpful to include a cross-reference to Section 2.4 to reinforce the structure and cohesion of the manuscript.

Line-specific suggestions:

- **Line 249:** “*we apply*” → “*we applied*” (to maintain past tense when describing the methods used).

- **Line 252:** *"Using the cause-specific exposure-response function, we estimate excess deaths..."* → Consider revising to *"we estimated excess deaths..."* to align with the use of past tense in the rest of the methodology section.
- **Line 264:** Add *"the"* before *"concentration"*.
- **Line 264:** Add a comma before *"respectively"*.
- **Line 265:** *"Age specific RRs (Relative Risks) for IHD and stroke, are obtained using MR-BRT."* → Remove the comma after *"stroke"*: *"Age-specific RRs for IHD and stroke are obtained using MR-BRT."*
- **Line 265:** *"For LC, T2-DM, and COPD uniform RR_{c,d} were used across all age groups among adults."* → Add an article: *"For LC, T2DM, and COPD, a uniform RR_{c,d} was used across all age groups among adults."*
- **Line 275:** *"For the concentration data generated using SSP emissions, we apply the respective SSP projections..."* → For consistency in verb tense: *"we applied the respective SSP projections..."*
- **Line 294:** *"Notably, there are projected declines in BC emissions after mid-century under SSP245 and SSP245."* → There is a repetition of *"SSP245."* Based on Figure 2, it seems this should refer to *"SSP585."* Please verify and correct the second scenario accordingly.
- **Line 341:** *"Western Africa and Eastern"* → Suggested revision: *"Under the UNEP baseline scenario, BC, OC, and NO_x emissions are projected to be largest in Western Africa and Eastern Africa, followed by Central Africa, Southern Africa, and Northern Africa, by 2050..."*
- **Line 397:** *"The SSPs also demonstrates"* → Should be *"demonstrate"* (plural subject).
- **Line 407:** *"Additionally, Under the ECL6 CLE scenario"* → The word *"Under"* should not be capitalized: *"Additionally, under the ECL6 CLE scenario..."*
- **Line 529:** *"even in scenarios projecting modest PM_{2.5} decreases (ECL6 SDS, SSP1-1.9, UNEP 2063, etc)"* → The use of *"etc."* is too vague for academic writing. If possible, specify the remaining scenarios or remove the phrase altogether.
- **Line 531:** *"This further highlight that there are already high PM_{2.5} concentrations"* → Should be *"highlights"* to match the singular subject *"This."*
- **Line 545:** *"the R_{Fari} in 2050 relative to the baseline is negative in the UNEP scenarios, SSP119, and ECL6 SDS scenarios."* → To avoid repeating *"scenarios"*, consider rephrasing: *"the R_{Fari} in 2050 relative to the baseline is negative in the UNEP, SSP119, and ECL6 SDS scenarios."*

- **Line 554:** *"This shows the dominating influence of changes in scattering aerosols in the scenarios."* → Consider replacing “dominating” with “dominant”, which is more natural in this context.
- **Line 559:** *"Since emissions of changes in scattering aerosols dominate, the result is a positive radiative forcing."* → The phrase “emissions of changes” sounds awkward. A clearer option would be: *"Since changes in scattering aerosol emissions dominate, the result is a positive radiative forcing."*
- **Line 561:** Add “the” before “relative importance of different aerosol emissions.”
- **Line 566:** *"Hence, the negative radiative forcing is therefore nearly as strong in UNEP SLCP as in UNEP BASE."* → “Hence” and “therefore” are redundant. Consider removing one for clarity.
- **Line 570:** Typo: “ECL6 SDS” should be corrected to “ECL6 SDS.”
- **Line 582:** *"lack of detailed assumptions"* → Consider rephrasing to *"lack of detailed assumptions in some cases"* to make the meaning clearer, as “lack of assumptions” can be ambiguous.
- **Line 585:** *"there is the need for improved data"* → For smoother phrasing, revise to: *"there is a need for improved data."*
- **Line 588:** *"where “real-world’ emissions"* → The closing quote is incorrect. It should read: *"where 'real-world' emissions."*
- **Line 594:** *"Bonjour et al. (2013) and Chowdhury et al. (2023), noted"* → Remove the comma after “2023”: *"Bonjour et al. (2013) and Chowdhury et al. (2023) noted..."*
- **Line 685:** Replace “is” with “are” in reference to “assumptions”, which is a plural noun.
- **Line 717:** *"by 2050 except UNEP BASE and UNEP SLCP"* → For clarity and smoother flow: *"by 2050, except in the UNEP BASE and UNEP SLCP scenarios."*
- **Line 723:** *"across Sub-Saharan Africa"* → Within a sentence, “sub-Saharan Africa” should be in lowercase.
- **Line 734:** *"Accurate activity data and harmonization efforts are especially essential for upcoming assessment efforts"* → Consider rewording to avoid the repetition of “efforts”, e.g., *"Accurate activity data and harmonization are especially essential for upcoming assessments."*