

Dear Editor,

We, the authors of the study titled “Relationship Between El Niño-Southern Oscillation and Atmospheric Aerosols in Legal Amazon” are deeply pleased with your contributions in terms of review and suggestions. Undoubtedly, your review and suggestions have substantially raised the level of this study. We have endeavored to respond to your inquiries in the manuscript in a clearer and more objective manner, including some factors that strongly aid in understanding the study.

Major points:

1) The authors found that “statistically significant phase lags of up to 4 to 6 months were observed between ENSO indicators and atmospheric aerosols”. What is the physical mechanism causing these phase lags? How it will affect the cloud-radiation interactions in the Legal Amazon region.

We appreciate the pertinent questions. Before concluding the study, we considered incorporating this approach. However, following the review, we included a section "4.1. The Walker Circulation" (starting from line 488), addressing the physical mechanism to complement the findings. Additionally, we elucidated the relationship between clouds, radiation, and aerosols from line 602 in the topic "4.3. Aerosol Interaction," substantiating them with scientific discoveries to correlate them with the obtained results.

2) How are the future ENSO events going to influence the aerosol loading in the Legal Amazon region? After reorganizing the "5. Conclusions" section (from line 634), we added a brief discussion about future events. However, addressing predictions using climate modeling methods becomes challenging as the article does not deal with such forecasting.

3) The authors reported the impact of transported BC aerosols in the Legal Amazon region. Do you have any trajectory analysis to support this kind of transport?

In the Introduction and in explaining the results of EAOD-BC, we highlighted the impacts of Black Carbon transport. The cited articles provide sufficient support to explain these impacts. While we did not delve into the impacts of transport in the analysis, the indicators used for aerosol metrics are focused on concentration. However, we added the reference of Saturno et al. [21] to identify the periods when the Amazon is most affected by Black Carbon transport.

4) Authors found 100% increases in atmospheric composition during El Niño events compared to La Niña phase. Is it related to only atmospheric transport? Or any other factors are influence the aerosol concentration. Whether any emission sector-wise analyses available in both periods?

After reviewing the content, I realize there might have been a misinterpretation of terms, possibly interchanging mentions of El Niño with La Niña. I emphasized that the highest concentrations of

atmospheric aerosols occurred during La Niña events. There might have been confusion in mentioning that, during El Niño, these concentrations are more significant. However, we documented sectoral analyses, such as fire outbreaks, in the supplementary documents. We also mentioned that Atlantic Ocean conditions, modulated by ENSO, influence atmospheric aerosol concentration.

Minor points

- 1) The paper's objectives and outline need to be clearly mentioned in the manuscript. Better rewrite it. At the end of the introduction, specifically in the last paragraph (from line 93), we rephrased the study's objective and detailed it in bullet points.
- 2) Line 164: In Equation 1, better put 550 nm as subscript
We addressed this recommendation not only in that section but throughout the manuscript, using "AOD500nm" and "AOD550nm." This significantly improved the article's structure.
- 3) In the AERONET data, single scattering albedo values are also available. Why authors are not used this for absorption aerosols?
The AERONET data is valuable; however, we did not utilize the single scattering albedo as we aimed for a more spatial perspective through EAOD-BC. We briefly explained the reason for using EAOD-BC from line 179 to maintain methodological coherence while employing AOD.
- 4) The authors need to be more precise in their wording in the discussion and conclusion section.
The Discussion and Conclusion sections are more precise after the review, especially the conclusion, which was largely rewritten and adjusted.
- 5) Figures. It is not clear about the relationships in Figure 6 and 7.
We included brief explanations in each figure caption. While they may appear similar at first glance, each one analyzes the relationship between Niño 3.4 region SSTA and AOD, and the second figure addresses the relationship with EAOD-BC.