Project: **1257**

Project title: **Daily air quality forecasts for São Paulo**

Principal investigator: **Adrien Deroubaix**

Allocation period: **2024-07-01 to 2025-6-31**

Project Summary

The project aimed to improve daily air quality forecasts in the São Paulo metropolitan region by developing a novel method that adjusts anthropogenic emissions based on observed pollutant concentrations.

During the previous allocation, we implemented this observation-based emission scaling approach and analyzed a 10-week forecast period (February to April 2023). The results were submitted to *Earth's Future* (AGU publications), and the manuscript is currently under revision following a major review.

In response to the reviewers, we prepared a second simulation period (July to September 2024) to evaluate the robustness of the method over another timeframe. The revised manuscript will be submitted in the coming weeks.

The preprint of the submitted article is available at:
https://doi.org/10.22541/essoar.171352084.46269313/v1

Main Findings

Forecast accuracy was significantly enhanced for key pollutants such as NO_2, SO_2, CO, and ozone through the use of scaling factors derived from observed-to-modeled concentration ratios.

Among these, ozone forecasts showed the most substantial improvement following adjustments to VOC emissions, under the assumption of a NOx-saturated chemical regime, a condition that was validated for the São Paulo metropolitan area.

In contrast, forecasts of particulate matter (PM2.5 and PM10) remained more challenging due to the complexity of secondary aerosol formation processes and contributions from sources outside the modeling domain.

Overall, the observation-based emission scaling method proved effective and shows strong potential for application in other megacities, providing valuable top-down constraints to improve and refine traditional bottom-up global emission inventories.

Publications and Presentations

- Manuscript under revision for *Earth's Future*, AGU

- Oral presentation: *Klimapolis Symposium*, Natal, Brazil, 2023
  https://www.klimapolis.net/klimapolis-symposium-natal-2023-agenda-en

- Video presentation at the **CMAS Air Quality Conference 2025**
  https://airpollutionconference.com/

Data Archival

The transfer of selected simulation output to the DKRZ Long Term Archive has been done. For the rest of the data, arrangements have been done for the planned deletions.

Please do not hesitate to contact me if any further information is needed.

Kind regards,

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