



Tracking Air Pollution From Space: High-Resolution Daily Estimates For PM_{2.5}, O₃, NO₂ And CO

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This review verifies the reproducibility of the exhibits included in the paper "*Tracking Air Pollution From Space: High-Resolution Daily Estimates For PM_{2.5}, O₃, NO₂ And CO*".

Contents in this review:

1. Main findings
2. List of exhibits and reproducibility status
3. Reproduction Environment

Main findings

- **Every exhibit in the main section of the paper and in the appendix were reproduced accurately**
- The code was successfully executed on a new computer after:
 1. Opening the R project "aq_rp.Rproj"
 2. Restoring the environment by running `renv::restore()` and following the prompts.
 3. Opening the "wp/R Suites/o__Run_All_Programs.R" and running the code.
- The output demonstrates consistent stability across multiple runs. Specifically, executing the code two times consecutively yielded identical results.
- The code takes approximately 10 hours to run.
- We conducted our reproducibility analysis based on the paper shared by the authors in the reproducibility package.
- **Verification Process and Data Handling:**
 - The reproducibility package relies on two types of data: open, and restricted data.
 - Some open data is not included in the reproducibility package due to file size constraints.
 - Reviewers used restricted data provided directly by the authors to conduct the reproducibility verification, and this is not included in the public reproducibility package.
 - *data_hash_report.csv* lists the SHA256 hashes of all files in the Data folder to support data integrity checks. Users who acquire the forthcoming/accessible/limited-access/restricted data can use this file to verify that the data has not been altered.

- **Reproducibility Summary:**

- **Data:** Some data is restricted and has not been included in the reproducibility package. For more details, please refer to the README file.
- **Code:** All code files (from cleaning to analysis) are included in the reproducibility package.
- **Outputs:** All outputs are generated by code included in the reproducibility package.
- **Dependencies environment:** The reviewers created a new environment using the latest versions of dependencies available at the moment of the review.

List of exhibits and reproducibility status

Results in the Main Section of the Paper

- **Table 1 Reproduced.** Verified against R Results/Composite_Regression_Summary.docx.
- **Figure 1 Reproduced.** Verified against R Results/fig_01_pm25_24hr.png.
- **Figure 2 Reproduced.** Verified against R Results/fig_02_climate.png.
- **Figure 3 Reproduced.** Verified against R Results/Figure_3.png.
- **Figure 4 Reproduced.** Verified against R Results/Figure_4.png.
- **Figure 5 Reproduced.** Verified against R Results/Figure_5.png.
- **Figure 6 Reproduced.** Verified against R Results/Figure_6.png.
- **Figure 7 Reproduced.** Verified against R Results/Figure_7_panel_cities.png.
- **Figure 8 Reproduced.** Verified against R Results/Pollutant_Correlation_Boxplots_mod.png.

Results in the Annex

- **Appendix 1 - Pollutant: PM₂₅ Reproduced.** All figures have been verified against R Results/Comparative_FUA_TimeSeries_Plots.docx and are reproducible.
- **Appendix 1 - Pollutant: O₃ Reproduced.** All figures have been verified against R Results/Comparative_FUA_TimeSeries_Plots.docx and are reproducible.
- **Appendix 1 - Pollutant: NO₂ Reproduced.** All figures have been verified against R Results/Comparative_FUA_TimeSeries_Plots.docx and are reproducible.
- **Appendix 1 - Pollutant: CO Reproduced.** All figures have been verified against R Results/Comparative_FUA_TimeSeries_Plots.docx and are reproducible.
- **Appendix 2 - Pollutant: PM₂₅ Reproduced.** All figures have been verified against R Results/FUA_Full_Prediction_Plots.docx and are reproducible.
- **Appendix 2 - Pollutant: O₃ Reproduced.** All figures have been verified against R Results/FUA_Full_Prediction_Plots.docx and are reproducible.

- **Appendix 2 - Pollutant: NO₂ Reproduced.** All figures have been verified against R Results/FUA_Full_Prediction_Plots.docx and are reproducible.
- **Appendix 2 - Pollutant: CO Reproduced.** All figures have been verified against R Results/FUA_Full_Prediction_Plots.docx and are reproducible.

Reproduction Environment

Paper exhibits were reproduced on a computer with the following specifications:

- OS: Windows 11 Enterprise
- Processor: Intel(R) Xeon(R) Platinum 8562Y+ (2.80 GHz) (2 processors)
- Memory available: 128.0 GB
- Software version: R 4.4.0