

Dear referee,

Thank you very much for the valuable comments to our paper and suggestions for article improvements. The manuscript has been modified accordingly.

Below are the answers and modification on the manuscript. In the following: "RefC" is the comment from Referee, "AuthR" is the author's response and "AuthCM" represents the author's changes to the manuscript. Page and line number refer to the page and line number in the version submitted for discussion.

Specific comments

Introduction

Comment 1.

RefC: The introduction effectively outlines the problem and objectives but could benefit from a clearer emphasis on how this research fills existing gaps compared to other studies. Adding brief references to similar studies in other European cities could strengthen its relevance.

AuthR: Modified according to the reviewer's note.

AuthCM: Page 2, line 42: added references (Xu et al. (2021b); Knibbs et al. (2018); Lee et al. (2019)).

Methodology

Comment 1.

RefC: Explain the rationale behind the 3-point moving average for outlier removal. How does this choice affect the spatial resolution and data reliability?

AuthR: This choice does not affect the spatial resolution of the data, nor the data reliability, it just identifies the observation that differs significantly from its neighbors. The observation is invalidated when it is 1.5 times higher/lower than the average of the 3-points, observation included. In this way the spikes are removed and not induce additional bias and the real concentrations (even if they are higher) are kept. The 3-points window was chosen due to the spatial relevance, the pollutants concentrations are similar in a given area, which is rapidly passed by the moving car. To be more clear to the reader the text has been adjusted.

AuthCM: Page 4, line 111: "3 data points window was used to remove data-points with values higher and lower than 1.5 times the window mean." was changed to "3 data points was used to invalidate the data-points with values higher and lower than 1.5 times the window mean."

Results

Comment 1.

RefC: The analysis in Figure 5 ($PM_{2.5}/PM_{10}$ ratio maps) needs refinement.

AuthR: Modified according to the reviewer's note, see changes to manuscript.

AuthCM: Page 16, lines 333-337: changed to "The model shows the fine particle fraction ($PM_{2.5} / PM_{10}$) to be larger during the cold periods, compared to warm periods, with fine particles accounting for up to 95% of the PM_{10} concentration (Fig. 6). This is explained by the fact that household activities generate predominantly small particles and higher percentages are seen in the peri-urban regions (outside of Bucharest) where the house heating are contributing more (lighter color of purple, Fig. 6 right panel) to $PM_{2.5}$ concentrations.

During warm periods, fine particle fraction is approximately 50% within the city and less than 40% in the villages close to Bucharest where the agricultural activities increase the PM_{10} fraction (Fig. 6 left panel). The main rivers and lakes within Bucharest's perimeter are clearly sinks for small particles, producing lower fine mode fractions in both seasons.

Comment 2.

RefC: Borders in Tables: When zooming into the document, gaps are noticeable in the outside borders of tables. This may be due to uneven line weights, misaligned elements, or incomplete formatting. Please address this.

AuthR: Indeed, it was a technical issues in latex.

AuthCM: The Table borders have been redone.

Discussion

Comment 1.

RefC: Acknowledge the limitations of the mobile measurement route. For instance, areas with restricted car access might lead to underestimations.

AuthR: The configuration of the routes was designed to comprehensively cover the entire city while considering key factors: a) Pollutant Sources and Dispersion: Routes were planned to include areas with major emission sources and account for pollutant dispersion directions. b) Urban Typologies: The campaign ensured coverage of all relevant urban area types (e.g., residential, industrial, traffic-heavy zones) to meet the requirements of the dispersion model and provide representative data for the mixed-effects LUR model. This approach ensured that the campaign provided a robust dataset for high-resolution pollutant mapping while accounting for logistical, meteorological, and statistical considerations. Of course, the routes had to be designed to exclude the restricted areas for cars and in this way to exclude some urban areas (e.g. parks, agricultural zones and water bodies). To be more clearer to the reader the text has been adjusted.

AuthCM: Page 4, line 107: added text "The mobile measurement route is limited to the areas where the car has access, excluding some urban areas (e.g. parks, agricultural zones and water bodies)."

Comment 2.

RefC: The following suggestions would help the clarity:

Line 97: "...characterized by hot summers and cold winters." (clarify structure for conciseness).

AuthR: Modified according to the reviewer's note, see changes to manuscript.

AuthCM: Page 4 Lines 96-97: changed to " "Located in the southeastern part of Romania, in the Romanian Plain, Bucharest has a humid continental climate, characterized by hot summers , cold winters and two short transitional seasons, spring and autumn"

Comment 3.

RefC: Line 92-93: "...more industrialized, hosting a variety of manufacturing plants, such as machinery, textiles..." (remove redundancy).

AuthR: The recommended corrections were done in the text.

AuthCM: Page 4 lines 92-93: changed to "Most of the production sectors, such as machinery, textiles, chemicals, electronics, and business parks, all contributing significantly to the economic base of Bucharest, are located in the southern and western areas."

Technical corrections

Comment 1.

RefC: Line 164-165: aggregated values of the spatial predictor variables calculated in circular buffers with radii between 25 m and 2 km.”

For more Clearer phrasing: “...aggregated values of spatial predictor variables calculated within circular buffers ranging from 25 m to 2 km in radius.”

AuthR: The recommended corrections were done in the text.

AuthCM: Page 6 lines 164-165: changed to “... aggregated values of spatial predictor variables calculated within circular buffers ranging from 25 m to 2 km in radius.”

Comment 2.

RefC: Line361: “...in pointed pollutant variability mostly during warm season and higher concentrations...”

Suggestion: “...pinpointed pollutant variability mostly during the warm season and higher concentrations...” Reason: ”Pinpointed” should be one word, and ”the” is required before ”warm season.”

AuthR: The recommended corrections were done in the text.

AuthCM: Page 18 line 361: changed to “... pinpointed pollutant variability mostly during the warm season and higher concentrations...”