

Comments for Modeling the drivers of fine PM pollution over Central Europe: impacts and contributions of emissions from different sources by Bartík et al. (2023)

Bartík et al. quantified the contributions of various emission sources on the concentration of particulate matter across Central Europe. By applying the PSAT tool and using zero-out method in WRF CAMx model, they determined different major emission sectors for the PM_{2.5} concentrations for different reasons. They also performed two different group of simulations, SOAP and VBS experiments, based on different organic oxidation chemistry modules. The results of this research can offer recommendations for decreasing air pollution in this region. The results are well discussed with previous literature. The content aligns well with the *ATMOS CHEM PHYS*'s scope and I recommend considering publication after major revisions.

Major comments:

- The analysis of the model simulations shows a certain level of repetition. There are 15 figures, from figure 4 to figure 18, to show the impact of different emission sectors on PM_{2.5} and its components from different cases. Some of the figures can be combined, such as the figure 4 and figure 7. For figures on a similar topic, such as figures 10–13, authors can include one in the main text for detailed discussion while placing the others in the supplement, accompanied by brief descriptions in the main text. By doing so, the differences of impacts of different species can be addressed and it is easier for readers to follow.
- There are too many parentheses in the text and sometimes, using parentheses within parentheses, which strongly affected the clearness of the paper. Please consider moving the text outside the parentheses and revise accordingly, especially for the parentheses in the abstracts.
- Why does only figure 2 depict the analysis at the city level? It would be intriguing to include similar line plots illustrating the emission impacts on PM_{2.5} for these cities as well.

Minor comments:

line 7: delete the species details inside the parentheses.

line 10: Delete “an extreme case of the brute-force method”. The abstract should focus on the work done in the paper, not the limitations.

line 11: Full name of GNFR.

line 15: move the text out and revise like ”concentrations, with domain-wide average...”

line 15: A space should be used to signify the multiplication of units, such as $\mu\text{g m}^{-3}$. Please review all the units in the main text to ensure they comply with this rule.

line 19-20: It is better to describe the SOAP experiment first, rather than inside the parentheses.

line 55: Consider deleting the sentences inside the parentheses, as this information is already documented in line 51.

line 88: There is no description of what PSAT is about and what is the difference between PSAT and zero-out method. Since there is a separate group of simulation using PSAT, it is better to add several sentences to document how PSAT calculate the contributions of emission sections.

line 103: Avoid using parentheses within parentheses.

line 104: change “for one winter month (February) and one summer month (August) in 2010” to “during February and August of 2010.”

line 115: Consider deleting “(namely for PM_{2.5}, PM₁₀, and coarse PM) ”

line 144: Delete “(a detailed description of this revisions is presented in Ramboll (2022))”. Repetitive information.

line 147: What is CF?

line 158: Delete “(directly emitted) ”.

line 160: Delete “(condensable) ”.

line 180: Which wet deposition method in the Seinfeld and Pandis (1998) book? please be detailed.

line 207: Delete “(PM_{2.5} and PM₁₀) ”.

line 212: Change “,” to “.” after Passant (2002).

line 220: Direct use of SOA. Delete “secondary OA”.

line 239: Remove ”Since POA is...” out of the brackets.

line 247: Describe the SOAP and VBS simulations in two separate sentences.

line 257: Avoid using parentheses within parentheses.

line 264: Delete “Covering”.

line 277: Move the words “we also did ...” in the brackets out.

line 307: Change “:” to “.”.

line 308: “Their average underestimate in the base simulation of^{f***}” is repeatedly used. Consider revising, or deleting. It is also better to move the sentences out of the brackets.

line 326: Either use a separate sentence to describe the maximum results, or delete those values.

line 356: For these spatial map figures, it would be better to change sector names to emission source names, such as using Power Plants for sector A. It would be easy to understand the plots. There should be no punctuation symbols for figure titles. Please correct accordingly.

line 376: I also recommend using the emission source names, rather than sector symbols to explain the figures. It will help remove lots of redundant words.

line 407: The entire paragraph pertains to a figure in the supplement. It is excessively lengthy, and please condense the descriptions.

line 490: Change “:” to “.”

line 525: What’s (I)VOC?

line 731: Change “≈” to a word, such as “around”.

line 733: same as line 731.

line 769: Remove “who applied...” out of the brackets.

line 777: Remove the bracket and reorganize the sentences inside.

line 793: Remove “the average seasonal absolute contributions of”.

line 796: Remove “the average seasonal absolute contributions of”.

line 801: Add “from ” before “road transport”.