

Overall comments:

The study presents monitoring of a series of air pollutants, e.g., SO₂, NO_x, CO, CH₄, PM (black carbon, ions, PAHs and other organic matters), near ship terminals in the coastal city of Toulon, France. The dataset enables the derivation of emission factors (EFs) for these pollutants, while the application of positive matrix factorization (PMF) to HR-ToF-AMS measurements of organic aerosols (OA) allows quantification of different emission sources, including the contribution of shipping to local air pollution. The dataset is comprehensive, and the results and discussion are generally sound and logically presented. The findings contribute to methodologies for source apportionment, particularly for assessing shipping emissions in coastal areas, and provide valuable insights for implementing Emission Control Area (ECA) regulations in the Mediterranean region. However, several aspects require clarification and improvement before the manuscript can be considered for publication. I recommend a major revision, with detailed comments and suggestions provided below.

Detailed comments:

It is known that combustion-emitted organic compounds such as PAHs can partition between the gas and particle phases. For more volatile PAHs like naphthalene, gaseous concentrations are typically much higher than those in the particle phase. It seems that only particle-bound PAHs were analyzed in this study. What is the approximate fraction of the EF of particle-bound PAHs relative to total PAH EFs (including gaseous PAHs)? Given that gas-particle partitioning is temperature-dependent, to what extent might temperature influence the calculated EFs and the interpretation of the PMF results?

In lines 67-77: The authors mentioned the challenges of using PMF to apportion sources of OA, such as the merging of multiple sources into a single factor and overlapping mass spectral patterns. How does this study address these challenges and fill these gaps? What advanced or novel techniques were applied to resolve these issues? Including such a description somewhere in the manuscript would be beneficial and would enhance the significance of this work from a methodological perspective.

Figure S1 shows that there is a large military port near the study area. Are military vessels incorporated in the analysis of this study? In addition, military bases may be a significant source of OA. How much is known about military emissions, and could they influence the results of this study?

Equation 1: I think the equation should be $EF = \frac{\int_E^T [x](t) dt}{\int_E^T [CO](t) dt} \times \dots$, correct me if I was wrong.

In the caption of Figure 1, how were the organic peaks selected? It was stated that they represent the highest peaks (line 337), but this does not seem entirely accurate. For example, peaks 6 and 7 appear lower than some subpeaks around peaks 2 and 9. There are also several other signature peaks visible. Why were only ten peaks selected? It would be worthwhile to clarify this selection criterion.

Line 200-207: How was the contribution of ship emissions critically evaluated when the wind direction was blowing seaward rather than toward the observation site? I would expect that the instruments could not capture the plume in such cases. If so, although these emissions might not significantly affect local populations, they are still released into the atmosphere and could impact elsewhere.

Consider merging figure 3 into Figure 4.

I am curious about how the plumes were allocated to different ship emissions. What is the approximate lag time between plume emission and detection by the instruments? Is this lag time variable under different wind speeds? If so, this variability could affect the accuracy of source allocation among ship types. Additional explanation on this point would be helpful.

It may be worthwhile to include a brief description of the instrumentation in the Supplement, such as the operating parameters for the HR-ToF-AMS and some others, even though the source of the detailed method has been cited in the main text.

Line 179 and line 364-371, “a-value” is not easy to understand. Why was a range of 0 to 0.3 tested for the three shipping constraints, whereas a broader range of 0 to 1 was used for HOA and COA? Additional explanations may be helpful.

Small things:

Line 7: add “analysis” after PMF sounds more readable?

Line 24: seems “such” was missing before “as”

Line 58: doubled commas between “advancement” and “the”

Line 221, add “reported by Sinha et al. (2023)” or change to “(Sinha et al., 2023)”

Line 238, “with Zhang et al. (2024)’s findings”

Line 243, “the need of further measurements” sounds more natural.

Line 250-251: suggest rephrasing as “The EF of CO vary from 2.43 g/kgfuel to 57.87 g/kgfuel (median of 20.6 g/kgfuel), reflecting that factors like engine star-..”

Line 258, seems a space was missing before “respectively”

Line 258-259, “Among the ships identified none was LNG-fueled” is not clear, a comma was missing between “identified” and “none”?

Line 273-274; suggest rephrasing as “The mean CO EF of 0.38 g/kgfuel is consistent with reported EFs in Marseille in 2021 (Le Berre et al., 2024) (0.48 g/kgfuel for maneuvering ships) and from a cargo vessel (0.48 g/kgfuel) (Huang et al., 2018), reflecting typical emissions from diesel...”

Line 276, “sizes”

Line 280-283: “EFs”

Line 289-290: this sentence is not complete. Should be something like “ This pattern underscores the impacts of operation practices (such as..) on PAH EFs.

Line 292, “ lower than the value of 4 g/kg reported by ..”

Line 305: “Only cruise ships ~~were~~ equipped with scrubbers ~~and~~ were associated with...”?

Line 310: “understand shipping impact on air quality in coastal cities.”

Line 340: “measured” rather than “true”

Line 402: “(Sippula et al., 201)” rather than “ Sippula et al. (2014)”

Line 451:” peaks” rather than “peaking”

Line 464: “Table S9” rather than “Table S8”?

Line 476: “differentiated” rather than “differentiate”

Line 510-511 “The wind rose of this factor a local character similarly to HOA and COA factors and ...” The sentence is not clear.

Line 523-524: the sentence is not clear.

Line 528-529, is the global data originated from literature? If so, please include reference.

Line 545: Starting from PNSD 3, “number” was added between “PNSD” and the digit (not the case for PNSD 1 and 2). I would suggest keeping them consistent.

Line 550: “highlighted”

Line 557-558, I did see the point of this sentence. Was it a mistake?

Line 583, was the contribution of shipping factors to total PAHs (28%) accidentally the same to the contribution to APAHs (28%)?