

## REFeree #2

### *General comment:*

*The paper reports a long-term study of PM concentration and composition at two sites of eastern Mediterranean area. The trends of the contributions of the different sources are investigated by means of source apportionment. The topic is interesting and suitable for the Journal. The paper is clear and generally well written. I just have some minor suggestions detailed in my specific comments.*

We would like to thank the reviewer for his/her positive comments. Below a point-by-point response to the comments raised. Reviewer's comments are shown in *ITALIC* and our answers are presented in **BLUE**.

### *Specific comments:*

*Lines 30-35. I would suggest to mention the recent works on trends of composition and sources in a southern Italy background site that could be representative of a central or central-east Mediterranean area such as Merico et al (Atmospheric Pollution Research, 102668, 2025) and Giannossa et al. (Journal of Environmental Management 319, 115752, 2022).*

We thank the reviewer for this suggestion. The proposed references have been added to the revised manuscript.

*Section 2.4. All years have been used as a single input dataset?*

Indeed, the 9-year chemical composition data was used as a single PMF input dataset. This approach improves the stability of PMF factors and enhances the robustness of the results. Moreover, it produces consistent source profiles across the years, allowing us to track the evolution of each source contribution over time, which is the focus of this study. Such an explanation was now added in the manuscript.

*Lines 191-194. Here it seems that there is a decreasing trend on dust coming out from chemical mass closure; however, source apportionment results indicate an increasing trend of this source. Could this aspect be discussed in more detail?*

The decreasing trend of dust (based on dust-AOD) discussed in Lines 191-194 is observed until 2015 but does not persist thereafter. For the period covered by PMF analysis (2015–2023), dust estimated by both methods (chemical mass closure and PMF) exhibits an increasing trend, although the magnitude of this trend is different (see Tables 1 and 3). These differences arise from the fact that only PMF apportions different crustal elements among multiple dust sources, while chemical mass closure groups them all under mineral dust component. For instance, a substantial fraction of Fe was resolved by PMF in traffic factor, reflecting contributions from brake and tire wear.

*Lines 303-308. Regional fossil fuel combustion. I would suggest naming this component just as combustion sources because it is likely a mixed source including both traffic and biomass burning. This will justify the large OC/EC ratio and the aspect that biomass burning is surprisingly identified at traffic site but not a background. This kind of mixing could be due to the lack of a specific tracer for biomass burning such as levoglucosan and has been observed also in other sites.*

While the influence of biomass burning to this factor cannot be ruled out, it is expected to be minimal given that most  $K^+$  (a tracer of biomass burning; Fourtziou et al., 2017; Puxbaum et al., 2007) is found in the LRT factor. Therefore, the name “regional fossil fuel combustion” is kept to encompass contributions from fossil fuel sources. The fact that biomass burning is resolved at the urban site

(NICTRA) but not at the regional background is very reasonable given the large emissions from domestic heating during winter period (Bimenyimana et al., 2024; Christodoulou et al., 2023). In contrast, the regional background (AMX) is only affected by episodic forest fire emissions during summer (Bimenyimana et al., 2024). Although levoglucosan has been used to resolve biomass burning source at various sites, it may be inappropriate for our regional background site given its fast atmospheric oxidation, leading to a significant degradation of this species during long range transport (Theodosi et al., 2018).

*The profile named LRT is usually called sulphate or secondary sulphate in PMF-based source apportionment. I would suggest to consider this flag.*

Although our LRT is usually labelled as “sulphate” or “secondary sulphate” in PMF-based source apportionment studies, we propose naming this factor “Regional secondary aerosol” to account for the other secondary species, such as secondary organic aerosols, that it contains and to better reflects its regional origin rather than limiting its interpretation to a single chemical constituent.

## REFERENCES

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