

Dear Referee#3,

Thank you for your valuable comments that will help improving this paper. Please find below the response of the authors.

1. Dust evaluation:

Referee comment: “The applied methods are well described or cited but in case of the dust evaluation the applied calculations are allowed for aerosol samples with sodium contents of purely marine origin.”

Authors’ answer: the applied calculations indeed assume aerosol samples with sodium of purely marine origin. As you have mentioned, the authors do agree that this assumption is not fully correct given the other existing sources of aerosols containing sodium. Therefore, given the limitations associated with the dust evaluation, we decided not to discuss into details this chemical fraction (e.g. see page 24416, line 20 to 24).

2. Comparison between filter and on-line determined masses:

Referee comment: “The TEOM-FDMS underestimates masses because the operating temperature of 30°C: ammonium nitrate and some SVOC were lost.”

Authors’ answer: the sentence page 29403, line 19-22 has been modified as follow: “However, filter measurements exhibit mass concentrations about 6% higher than the on-line method (slope±1 standard error=0.938±0.007). This can be related to temperature differences during filter sampling (ambient temperature) and TEOM-FDMS measurements (30°C), leading in the latter case to a partial volatilization of semi-volatile materials”.

Referee comment: “Fig. 3 delivers lower concentration in TEOM data than in filter samples. The sentence in lines 24 to 27 at page 29403 delivers an opposite result and is wrong!”

Authors’ answer: The sentence in lines 24 to 27 at page 29403 refers to TEOM-FDMS mass taking into account semi-volatile materials, contrarily to what is discussed in the same paragraph above and in Fig. 3; this is why in that case the TEOM-FDMS mass is higher than the gravimetric mass. Following your comment and a comment of referee#1, this distinction has been clarified:

Page 29403, line 15: this sentence has been modified as follow: “TEOM-FDMS was running at 30°C and was not corrected for semi-volatile materials (i.e. only the reference signal of the TEOM-FDMS was used here, without taking into account the SVM mass provided by the FDMS), in order to be as close as possible to our laboratory conditions.”

Page 29403, line 24-27: this sentence has been modified as follow: “In addition, taking into account semi-volatile materials in TEOM-FDMS measurements (i.e. adding the SVM mass provided by the FDMS to the reference signal of the TEOM-FDMS) leads to higher concentrations compared with the gravimetric method (18.4 versus 14.8 $\mu\text{g m}^{-3}$, respectively, on average at the URB site).”

3. EC concentrations:

Referee comment: “In other European cities highest EC concentrations were reported during the winter months (e.g., H. Puxbaum et al. / Atmospheric Environment 38 (2004) 3949–3958; M. Glasius et al. /Atmospheric Environment 40 (2006) 7115-7124). Do you have an explanation why in Paris not?”

Authors’ answer: as mentioned by the reviewer, higher EC concentrations were reported in other European cities compared with the levels reported in our study.

First, this might partly be explained by the flat orography specific to the region of Paris, which favours the dispersion of pollutants. A comparison of EC levels measured at different urban background sites in Europe has been conducted here, based on the work of Putaud et al. (2010). In terms of absolute concentrations, annual EC levels of selected urban background sites are: Paris-FRA URB site (1.4 $\mu\text{g m}^{-3}$), Duisburg-GER (2.5 $\mu\text{g m}^{-3}$), Llodio-SPA (2.7 $\mu\text{g m}^{-3}$), Bologna-ITA (2.9 $\mu\text{g m}^{-3}$) and Barcelona-SPA (3.7 $\mu\text{g m}^{-3}$). In terms of relative contribution to $\text{PM}_{2.5}$ mass, EC contributions are: Paris-FRA URB site (10%), Duisburg-GER (10%), Llodio-SPA (11%), Bologna-ITA (8%) and Barcelona-

SPA (13%). Even though EC levels are significantly lower in Paris compared with the levels reported in these selected European cities (1.8 to 2.6 times), EC relative contributions to PM_{2.5} mass are comparable (8-13%). This indicates that in Paris, not only EC, but also PM_{2.5} levels are lower than what is reported in other European studies. This observation might be explained by the dispersive conditions observed in the region of Paris due to its flat topography.

In addition, discrepancies in EC levels may arise from different analytical methods. Still very few papers have reported EC concentrations determined by EUSAAR-2 protocol. Location of the sampling site may also increase/decrease EC concentration levels. Our urban sampling site was located on the terraced roof of a 5-stage building and for this reason, may be considered more characteristic of background conditions than other sites located at the street level. Last but not least, EC emissions are expected to decrease with the renewing of the vehicle fleet and may also explain lower concentrations for the most recent studies.

4. OC to OM conversion factor:

Referee comment: ““An overestimation of sea salt leads to an underestimation of dust in this evaluation followed by an overestimation of OM caused by a conversion factor f_{OC-OM} which is too high. (...) Unaccounted amounts of the aerosol do not exist in this study – aerosol water is low at rel. humidity of 30 % but not zero – look into the cited paper of Sciare et al.! Considering all these remarks the conversion factor f_{OC-OM} may be lower than estimated and then in a better agreement with many earlier publications.”

The authors agree that your different remarks (e.g. water content at relative humidity below 30%, misestimation of dust, etc.) could partly explain the relatively high OC to OM conversion factors found in our study. These remarks have therefore been mentioned in the manuscript as follow:

Page 29407 line 4: “It should also be mentioned that the relatively high conversion factors found in our study could be related to i) possible aerosol water content - even at RH below 30% -, which is not taken into account in our mass closure calculation and ii) possible errors from the applied functions defined for the calculation of sea salt and dust (see Putaud et al., 2010 for a quantification of these errors).”

Note: please also see the authors’ answer to the Comment #3 of the Referee 1 which could explain the high f_{OC-OM} values determined, due to the strong homogeneity of OC in the region of Paris and its aged (i.e. oxidised) nature.

Additional corrections:

Page 29410: Germany has been added in the last sentence.

Page 29398, line 9: “Pall Gelmann” has been replaced by “Pall Gelman”.

Page 29401, line 12: the acronym “SIA” has been written in roman type.

Page 29402, line 22: this bracket was referring to a publication written by Patashnik and Rupprecht in 1991; following your comment, the name of the company “Rupprecht and Patashnik Co., Inc.” has also been added.

Thank you again for your help.

Kind regards,

The authors