

Interactive comment on “Variability of levels and composition of PM₁₀ and PM_{2.5} in the Barcelona metro system” by X. Querol et al.

Anonymous Referee #2

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The MS deals with the concentration levels, properties, sources of and exposures to aerosol particles in two underground railway stations and metro vehicles in Barcelona. Besides characterizing the chemical composition and speciation of some elements, the authors also described some potentials of improving air quality in undergrounds railway systems. The topic and objectives of the MS are definitely timely and are of interest for international research community. In addition, the MS represents a useful contribution to the growing literature on the air quality in underground railways. The methods utilized were selected well for the purpose of the study, and give basis for a rather comprehensive study. Measurements with high-time resolution were combined with aerosol sampling and analyses. The quality assurance of the optical instruments was handled in an acceptable manner. The MS can, however, be improved in some ways.

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General comments

First of all, the MS is very difficult to read and follow in detail. According to the present reviewer, it should be somewhat shortened and clarified, some figures are unnecessary over-sophisticated, and many variables are handled at a time. It should be more emphasized that the results for S-L9 station concern two different ventilation regimes, which - as the authors demonstrated nicely - has a huge impact on the concentration levels. Strictly speaking, these two periods are only comparable with limitations.

Air flow within the tunnels and in the platforms can be substantial. This leads to wind erosion which is not included into the list of main emission sources (Page 6658, lines 18-26), and it is not discussed at later stages. This should be adopted.

The authors should revise their rounding off strategy at many places in the text and tables. Here is an example from page 6666, line 4: 1.442 ± 0.2 . The number of significant digits - as it is for the former value - often suggests that the relative precision is better than 1%. This is generally questionable and it requires additional discussion and explanation.

The author's statement on page 6671, lines 21-23, and 6680, lines 4-5 that they were the first to identify the major Fe species is not fully correct. There were indeed only few papers dealing with the chemical speciation of elements, mainly transition metals in metros published earlier. Nevertheless, there are some, which are missing from the MS. Their list definitely includes the following articles 1) Karlsson et al., Subway particles are more genotoxic than street particles and include oxidative stress in cultured human lung cells. *Chemical Research in Toxicology* 18, 19-23, 2005, 2) Karlsson et al., Mechanisms related to the genotoxicity of particles in the subway and from other sources. *Chemical Research in Toxicology* 21, 726-731, 2008, and 3) Salma et al., Properties and sources of individual particles and some chemical species in the aerosol of a metropolitan underground railway station, *Atmospheric Environment* 43, 3460-3466, 2009. These papers and the important and relevant information contained

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therein should also be included into the present MS, and the discussion on the speciation of Fe should be modified accordingly, and should be put into an international frame.

The authors also measured the ambient atmospheric concentrations for several aerosol constituents near the stations. This would allow them to calculate crustal enrichment factors (EFs) for both the metro aerosol and aerosol in the ambient urban air. The ratio of these two EFs represents an enrichment of an element relative to the urban air. This quantity could help in further identifying or confirming some emission sources. It is advised that this characteristics is calculated at least for selected elements such as Fe, Cr, Ba, Mn, As and Cu.

Detailed comments

Page 6656, line 13 and many other places in the text I would suggest that the unit expressed as “ $\mu\text{g PM}_x \text{ m}^{-3}$ ” is avoided, and the correct unit for PM_x mass concentration of “ $\mu\text{g m}^{-3}$ ” is used instead.

Page 6658, line 7 The authors may want to write passenger car instead of private car.

Page 6662, line 8 Replace: opened 2009 by opened in 2009.

Page 6664, lines 25-27 Explanation needed for “the coarse fraction retained in the $\text{PM}_{2.5}$ cut of inlets”. Does this mean that the particles from the pre-selection device were further investigated?

Page 6666, line 23 Full stop needed.

Page 6666, line 25 Rewording is advices for “extraction well is extracting”.

Page 6669, line 11 Correct wording to “by buses or cars”.

Page 6673, line 19 Put a space between $1.5\mu\text{g}$.

Page 6679, lines 20-21 It is not completely clear what the next sentence means: “In the

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Barcelona's Metro, levels of Fe ranged from 144 and 55 μgm^{-3} in PM10 and PM2.5 respectively, for F-L3 to 9 μgm^{-3} in PM10 for the first 8 days at S-L9...". Rewording is required.

Page 6705, Fig. 3 The axis label and scale for the abscissa is missing.

Page 6706, Fig. 4 It is extremely difficult to differentiate between the curves for PM2.5 and PM1 in Fig. 4. Another solution for this would be appreciated.

Some other smaller typing errors should also be corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 6655, 2012.

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