

## ***Interactive comment on “Meteorological-gaseous influences on seasonal PM<sub>2.5</sub> variability in the Klang Valley urban-industrial environment” by N. Amil et al.***

### **Anonymous Referee #1**

Received and published: 30 November 2015

#### **General comments:**

Amil et al. investigate the variability of PM<sub>2.5</sub> with season, meteorology, and gas-phase species in an urban-industrial location in the Klang Valley, Malaysia. The authors present results from data collected over a period of approximately one year, detailing the PM<sub>2.5</sub> chemical composition and its temporal variation, as well as applying factor analysis to identify potential sources of PM<sub>2.5</sub> in the area. To put the findings from this study into context, the authors compare the results to those from previous studies from the same location and similar locations. However, the uniqueness and importance of the study are not highlighted thus it is not obvious how the findings from this work

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contribute to scientific knowledge. The paper is unnecessarily long, which is in part due to the results detailed in tables being described in full and partly due to the extensive comparison of the findings with those from other studies. Although the results are interpreted in line with the title of the manuscript i.e. how meteorological and gaseous parameters influence PM<sub>2.5</sub> variability, little is offered in the way of the significance or importance, which would strengthen the paper if included. For example, the factors identified from PMF analysis are correlated with various parameters with the results described e.g. strong positive or negative correlations, but it is often not suggested as to why such correlations are observed. Similarly, the motivation for some of the analyses is missing. The figures could also be greatly improved, particularly in the time series plots where the text is difficult to see. However, once these major revisions have been addressed along with the comments below, I recommend this manuscript be published in ACP.

#### **Specific comments:**

Abstract, page 26424, line 5: It may be useful to briefly mention that the seasons are characterized by monsoons/wind flow rather than the more typical summer/fall/winter/spring classification.

Abstract, page 26424, line 6: Please clarify what is meant by the ‘aerosol pattern’ e.g. temporal, spatial.

Abstract, page 26424, line 22: It is not clear how information on the coarse particles was obtained as a high volume PM<sub>2.5</sub> sampler was used in this study.

Abstract, page 265424, line 25: Please state in which order the CMC components are listed e.g. in decreasing order of mass or mass contribution.

Page 26426, line 1: Please clarify what is meant by ‘background of an area’.

Page 26426, lines 8-15: It is not clear why the findings from these studies in particular are referred to; are the locations close by or the conditions/locations similar to that of

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this study?

Page 26426, line 27: To describe receptor modeling as measuring PM and working backwards to determine sources seems a bit too simplistic. Please expand on the latter half of this sentence. For example, receptor modeling uses temporal and chemical variations to separate total PM into different factors, where marker species are used to identify the sources.

Page 26427, lines 4 and 7: What is the difference in these versions of PMF and is it noteworthy?

Page 26427, line 14: Why is one of the current trends to apply more than one receptor model for SA? Please expand on the purpose, such as is it to increase the confidence in the results or to better characterize the full PM2.5 due to limitations of each of the model or to enable comparison of the results with those from other studies that have used different techniques?

Page 26428, line 20: Please clarify what is meant by wind flow. Is it a combination of speed and direction? Is it a quantitative definition as it is stated in Section 3.1.4 that wind flow correlates with PM2.5 mass? How exactly is it used to distinguish the seasons e.g. a significant change in the wind flow for a period of time?

Page 26430, line 13: Why were the samples stored overnight in the refrigerator? Is it because the analysis needed to be performed all in one day or is refrigeration a necessary part of the chemical analyses method?

Page 26430, line 20: Why are only 6 method blanks used to calculate the MDLs as there were 12 (one from every moth)? Are the other 6 used for the analysis as detailed on page 26431, line 17?

Page 26433, line 23: has this approach been used in other studies? Please provide a citation if so.

Pages 26433-26434, Sections 2.5.2. and 2.5.3: Due to the low recovery of Al, nss-C9891

Ca<sup>2+</sup> was used for CMC and yet Fe was used for the EF analysis. How confident are you that the use of these elements are giving similar results as to if Al had been used? Why was Fe chosen as the reference element for the EF analysis?

Page 26434, line 20-21: As stated, Cesari et al. (2012) defined EF between 2 and 4 as being of mixed origin. Is there a range in EF values for mixed origins in this study?

Page 26435, Section 2.5.4: Please provide a few lines of overview on the source apportionment analysis.

Page 26436, line 7: Why does low wind speed result in low concentrations? Low wind speeds can result in stagnant conditions thus leading to a build-up of pollution. Is the pollution in this region mostly transported?

Page 26439, lines 2-6: Please can you suggest why these correlations may be the case? For example, the significant positive correlation of PM2.5 and O<sub>3</sub> possibly indicates a secondary source of PM2.5 as well as the already identified combustion-related traffic source, which is primary.

Page 26439, lines 26-27: Again, please suggest some reasons for these negative/positive correlations.

Pages 26439-26440, lines 29-2: According to the table this statement is incorrect. The SW monsoon has a negative relationship with RH whereas the HAZE has a positive relationship with RH.

Page 26440, lines 17-18: What is the importance/significance of the cation:anion ratio? Is it to indicate neutralization or dominance of a source type, for example?

Page 26441, line 11 and Figures 3a and 3b: Where is the value of 19% from in the text? The annual values in Fig. 3a differ to the annual values in Fig. 3b.

Page 26442, lines 14-15: According to the table legend, what is stated in the text is not how the NR was calculated. NR = [NH<sub>4</sub>]/[SO<sub>4</sub><sup>2-</sup>] + [NO<sub>3</sub><sup>-</sup>] in the table legend. Should

these concentrations be divided by the respective molecular weights?

Page 26442, lines 15-23: What is the importance of the NR value? If only just more than half of the aerosol acidity has been neutralized by ammonium what implications does this have?

Page 26443, lines 7-8: What does this sentence mean? How was the slight difference in these elements identified? What are they different to?

Page 26444, lines 23-25: Why might the results from this study be low compared to most other SEA cities? Please offer some possible reasons.

Page 26447, lines 1-9: If this factor (combustion of engine oil) predominantly primary, why might the reason be that a positive correlation is observed between O3 and this factor during INT.2?

Page 26447-26448, lines 28-1: This sentence (and similar sentences in other sections describing the factors) needs to be rephrased. Currently it sounds like the correlation is between HAZE and the gases, when it is the correlation of the factor with the gases during the HAZE period.

Page 26448, lines 20-22: What is the relevance of the discussion on different uses of potassium to estimate biomass burning? For example, is the Kb indicator used in this study?

Page 26449, lines 25-26: Please consider rephrasing this sentence to something like 'The strongest correlations between this factor and gaseous-meteorological parameters were observed during the SW monsoon season'.

Page 26450, lines 17-18: What about the EF analysis of Se and Rb? These two elements are not discussed in this section.

Page 26451, lines 11-13: Please list some of the possible anthropogenic activities in the surrounding area that could produce ammonium nitrate.

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Page 26452, lines 21-23: This result is not obvious. If this was the case then it would be expected that INT.2 had the lowest ratios.

Page 26453, lines 18-23: These few sentences are not necessarily needed as it is all detailed in the table that is referred to in the text. Possibly shorten these sentences or use the values to compare the composition of the two HAZE periods rather than listing the contributions of the sources.

Page 26454, lines 15-18: Please clarify that during HAZE 2011, strong correlations are observed but they are not significant.

Figures and Tables: Page 26475, Figure 1: Please consider adding a few place names to the map in figure (a). What does 'trunk' refer to in the legend of figure (b)?

Page 26476, Figure 2: Please state what the box and whiskers represent e.g. 5th and 95th percentiles. The size of the text in figure (a) in particular is too small and difficult to read.

Page 26478, Figure 4: What do all the different lines in figure (b) represent?

Page 26479, Figure 5: Should figure (c) be a fraction or percentage if it is relative contribution or mass concentration rather than contribution?

Supplement: Table S1: It is not necessary to have as many decimal places as are used here. Consider using 3 significant figures throughout. What is SO42-SO2?

Figure S1: This figure is very hard to read. Possibly making the figure landscape rather than portrait might help. The synoptic wind fields in particular need to be addressed.

Figure S2: Please consider using color in this plot as well as the different symbols as it's very difficult to tell the fit lines from the data points apart. The cluster of points towards to the lower left of the plot all merge too even though different symbols are used. Color would probably really help this figure.

Figure S3: This figure is not particularly simple to interpret. Please consider including

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additional horizontal lines and tick marks to indicate the different levels of EF (the different source types cut offs as well as the highly enriched, moderately enriched values etc.).

Figure S4: Similar comments as for Fig. S1. The figure needs to be made clearer.

Minor and technical corrections:

Abstract, line 14: Please consider rephrasing this sentence to something like 'On a daily basis, the PM2.5 mass ranged between 6 and 118  $\mu\text{g m}^{-3}$  with the daily WHO guideline exceeded 43 % of the time.'

Abstract, line 21: Please define TSP.

Abstract, page 26425, line 2: Please define SIA.

Page 26425, line 14: Please consider using a different term than 'pristine' such as rural or less polluted.

Page 26425, line 19: Please consider using a different term than 'stable' as this is usually used more for radioactive species rather than volatilities. Perhaps just say that the fine particles are composed of compounds of a range of volatilities.

Page 26427, lines 8 and 10: Remove the word 'has' after the reference.

Page 26428, line 19-20: Please consider including some values for the uniform temperature, high humidity etc.

Page 26429, line 3: Change 'were' to 'are'.

Page 26429, lines 4 and 5: it is not necessary to provide all of these values to 2 decimal places. Please consider using 3 significant figures here and throughout the manuscript.

Page 26430, line 22: Change 'use' to 'used'.

Page 26431, line 3: Is power of 0 W correct for setting number 2 or is this a typographical error?

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Page 26433, line 23: Please rephrase this sentence as 'nss-Ca<sup>2+</sup> over the mineral contribution' does not make sense.

Page 26435, line 5: Please change 'remain as it is' to 'remained as it was'.

Page 26435, line 19: Please change 'days' to 'daily'.

Page 26436, lines 6-7: Please rephrase this sentence to something like 'The small number of exceedances during the NE monsoon was due to...'.

Page 26436, line 23: Please change 'ompared' to 'compared'.

Page 26439, line 9: Insert 'is' between 'which' and 'also'.

Page 26441, line 12: Please consider removing 'of the 34% chemical composition determined' as this makes the sentence a little confusing.

Page 26451, line 20: Insert 'other' between 'the' and 'hand'.

Page 26453, line 16: Change 'characters' to 'characteristics'.

Page 26472, Table 2: A reference for the Gombak study is missing.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 15, 26423, 2015.

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