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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Haze in the Klang Valley of Malaysia" *by* M. D. Keywood et al.

Anonymous Referee #3

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Comments on "Haze in the Klang Valley of Malaysia" by Keywood et al.

General comments

This paper addresses the haze in the Klang Valley of Malaysia. The authors investigated this important air pollution issue, caused by airborne particles, using a combination of field measurements, analytical methods, and modeling studies. The data set reported in the paper is very original. The paper is generally well written, although some sections are ambiguous because of the use of certain terminology and phrases. The paper certainly needs several amendments before it is published on ACP. I am giving below my suggestions as the paper is read.

Specific comments

Abstract: what does the word "smoke" refer to? Is it "biomass smoke"? Since this phrase is used quite frequently in the paper, the authors should define it explicitly. Line

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8- The sentence "The evidence for smoke being a significant contributor to aerosol duringĚ." is very long and ambiguous. What aspects or properties of aerosols are particularly affected by "smoke"? This sentence should be rewritten with specific reference to aerosol mass concentration or aerosol chemical composition or aerosol scattering as the case may be. Line 14- "the domestic source of secondary particle production" - what types of secondary aerosols (OM or IM or both) are found in the Klang Valley? Define them explicitly.

1. Introduction:

Page 617, line 12- "These particles are important in the development of haze because they are within the size range that scatters light most efficiently". Specify the size range.

Page 617, line 21- "Neither study involved a direct measurement of haze intensity, i.e. aerosol scattering coefficient". Atmospheric visibility reduction is due to both light scattering and light absorption. Since light absorption is not measured in this study, this should be clearly indicated in the paper. There is no mention about light absorption at all in this paper although the elemental carbon (or rather BC) accounted for a significant fraction of the aerosol mass in the Klang Valley.

Page 618, line 4- "The Malaysian Haze studyĚ.. and other properties of aerosol hazeĚ". Please state clearly what "other properties" were measured in this study. The term "aerosol haze" is confusing and is not scientifically correct. I suggest that a more appropriate term be included.

Page 618, line 16- "In this work, two major sources of particles, smoke and secondary production, are discussedĚ" "Smoke" may introduce both primary and secondary aerosols, so please reword this sentence to avoid ambiguity. Was it possible for the authors to distinguish between secondary aerosols produced within the Klang Valley and those transported from long distant sources (smoke)?

2. Methods

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2.2. Measurement methods

Page 619, line 12- "The nephelometer was operated with a heated inlet and heated chamber to minimise effects of hygroscopic growthĚ" At what temperature was the inlet maintained ? Was the resultant RH estimated? I thought the purpose of having a heated inlet was to prevent condensation inside the nephelometer unit. Was any attempt made to calculate the RH-adjusted light scattering coefficient based on ambient RH?

Page 619, line 25- "Three out of every four samples were collected on the combination of TEF and PC filters." What was the reason for using PC filters? What analytical measurements were made with those filters? These details should be included.

Page 619, line 28- " Samples were collectedĚ. except during periods of excessive haze when daily samples were collected." What criteria were used to determine excessive haze before deciding on the sampling frequency, especially at the Gombak site, given that the haze events were sporadic?

2.3 Analytical methods

Page 620, line 20- "TC was determined using thermal decomposition to CO2Ě" Please specify the temperature at which the furnace was maintained.

Page 621, line 3- Many ions in aerosols were determined, but not all these ions are discussed in the paper. Even the important ions such as NO3- are not sufficiently addressed in the paper.

3. Observations

3.1 Aerosol scattering coefficient

Page 622, line 11- "The actual coefficient Be is approximated by the dry scattering coefficientĚ" Is this assumption valid, given that more than 33% of the aerosol mass is due to EC, which is light absorbing?

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Page 623, line 7- "The generalised pattern on Bsp can be attributed to the diurnal changes in the source of particles (i.e. traffic emissions)." What aerosol components emitted by the local traffic can contribute to the light scattering? Please spell it out.

Page 623, line 14: The description of Figure 3 (a to d) given in the text does not seem to agree with the actual plots shown ? For example, Figure 3c shows the variations of Bsp and PM10. However, according to the figure caption, the two temporal variations in Fig 3C refer to those of Bsp at Petaling Jaya and Gombak. Which one is correct? Figure 3d also has a similar discrepancy.

3.2 Aerosol mass

Page 624, line 11- It appears that daily aerosol samples were taken only for a limited number of days during July/August 2000. This is not consistent with the information given in the abstract that aerosol samples were collected on a daily basis during periods of excessive haze.

3.3. Aerosol Chemistry

Page 625, line 5- what are the likely sources of SO2 in the Klang Valley? Briefly discuss the relative importance of these sources in the context of haze.

Page 625, line 11- EOM seems to be over-estimated since the difference between GM and EC + IM also includes the measurement uncertainty and unidentified species. The nitrate concentration reported in this paper is very low for an urban site like Petaling Jaya, which has heavy traffic emissions. Additionally, this paper provides virtually no discussion at all on the nitrate.

Page 625, line 14- see sec 4.4 for details. There is no section 4.4 in this paper.

3.4 Mass balance

Page 626, line 19- Equation 3 should be TC = OC + EC (not OM + EC as indicated in the paper). The thermal decomposition method employed in this study can only

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measure carbon and not the carbonaceous materials.

Page 626, line 23- Figure 7: According to the text, this figure represents 24 samples, but only a few data are shown in the figure. Why?

Page 627, line 2- Figure 8: This figure shows the average contribution of aerosol components. The average aerosol mass concentrations measured at both sites must be given in the text or in the figure caption. Without this information, it will be very difficult for the readers to assess their importance in haze-related issues. As part of IM, a pie corresponding to "others" is shown. What are those species? Why are those species much higher in Petaling Jaya compared to Gombak? It is rather surprising to see such a large proportion of oxalate at both sites, which suggests that this organic acid is not predominantly derived from biomass burning. Again, the nitrate concentration is very low for an urban site considering the fact that it is derived from combustion sources.

Page 627, line 11- "Oxalic acid is present in the cellulose material of vegetation." There ought to be a reference in the literature for this. Cite this reference.

4. Discussion

Page 627, line 16- "Smoke from biomass burning is clearly a very important and at times the dominant source of aerosol at each site, as displayed by the predominance of EOM (Fig. 8) Ĕ." EOM might have been derived from both local urban sources and biomass burning, so the EOM cannot be used as a strong indicator of biomass burning.

Page 627, line 19- "Na and Si areĔ.. indicating that sea-salt and soil-dust are insignificant sources of PM2.5 aerosol." This finding is not surprising since these two elements are commonly found in the coarse mode.

Page 628, line 4- "We have not identified a vehicle emissions source Ĕ.." Is it not possible to identify the signatures of vehicle emissions based on the difference in the aerosol composition between the two sites, which are understandably influenced by different types of aerosol sources. Besides, Br- has been determined in aerosols in

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collected in this study, which is known to be a tracer for vehicle emissions.

Page 628, line 17- Since EOM appears to be over-estimated by the method employed in this study, it may be better to use the sum of EOM and EC for the comparison between haze and non-haze periods.

4.1 Smoke - seasonal variations

Page 629, line 1- Again, please state explicitly what the term "smoke" means in this paper.

Page 629, line 12- The larger Bsp values obtained during the SW season may be due to reduced rainfall rather than due mainly to fires in the region.

Page 631, line 11- why did the modeling study cover July 2000 rather than Aug 2000 for which more field data on haze seems to be available. HYSPLIT backward or forward air trajectories must be available at the Malaysian Meteorological Service. These air trajectories are widely used by the scientific community to assess the history and source of air masses being received at a sampling site, especially during air pollution episodes. Is there any reason for not showing these air trajectories in the paper?

5. Conclusions

In general terms, what can be concluded about the Haze in the Klang Valley based on the chemical analysis of aerosols ?

Is it possible to say which aerosol species or components contributed most to the aerosol light scattering based on the data available from this study? If so, this should be indicated in the conclusions.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 615, 2003.