

## ***Interactive comment on* “Size distributions of elemental carbon and its contribution to light extinction in urban and rural locations in the Pearl River Delta region, China” by H. Yu et al.**

**H. Yu et al.**

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Referee #2 Comment 1:

The authors report the measurement data of the EC size distribution at seven location in the PRD region, China. In addition, they calculate the light extinction coefficient based on the EC and other chemical species data. Most of the measurement data are collection of the measurements reported preciously by the authors. Thus, I think this part can be drastically reduced or shortened. For example, sections 3.1 and 3.2 can be combined into one section with concise description of the major characteristics.

Author Response:

C11974

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The measurement data in this manuscript is new and never published before, though our group has published three EC size distribution papers elsewhere, including a tunnel study in Guangzhou (Huang et al., 2006), an urban-sample study in Guangzhou in July 2006 using Nano-MOUDI measurement data (Yu and Yu, 2009), and an urban-sample study in Shenzhen (another city in the PRD) in summer and winter of 2004/2005 (Huang and Yu, 2008). In the current manuscript, measurements are conducted in both urban (in the months of January, April, May, July, October, November and December in 2006-2007) and suburban/rural sites (July 2006, August 2007 and January/February 2008) in the PRD region. The spatial variation allows us to study the evolution of EC size distribution from an urban site (source area) to suburban/rural sites (downwind area), and also makes it possible to compare contributions of EC to visibility degradation at these sites. In this manuscript, we have mentioned previous site distribution measurements in the region for comparison with measurements reported in this study. This may be the reason that led the referee to think that most of the measurement data are collection of the measurements reported preciously by the authors.

In our original manuscript, the sentence “Details are presented in our previous paper (Yu and Yu, 2009) (Line 16, p 23026) may be another reason for the reviewer’s misunderstanding. Here we meant that the method details for EC and OC determination (not the ECOC data presented in this paper) are presented in our previous paper. This sentence has been revised to clarify this issue.

## Comment 2

The approach they used in the estimation of the light extinction coefficient is an interesting one. I believe this kind of data analysis is a valuable one. However, there are several approximations or assumptions to calculate the light extinction coefficient. One example is that the observed light extinction values at HKUST used were obtained from a site 10 km from HKUST. With this kind of approximation, it is hard to validate the estimated values with the ‘so called’ observed one since the light extinction coefficients apart from 10 km might be significantly different.

## Author Response:

Although HKUST and Hong Kong observatory (HKO) are 10 km apart, the two locations are in the same air shed. We have compared the visibility data observed at Hong Kong observatory (HKO) with the data generated by forward scattering visibility sensor installed at HKUST (our sampling site) during the period of 1 Jan. 2008 to 31 Mar. 2009. Comparison of the historical records show that when the HKO visibility is lower than 16 km ( $\sigma_{ext,obs} < 244 \text{ Mm}^{-1}$ ), the HKO values are closely correlated with HKUST values (zero-intercept regression results:  $r^2 = 0.55$ , slope = 1.1,  $n = 1307$ ). Only on very clean days when the visibility at HKO is higher than 16 km, the HKO values are higher than HKUST values. For measurement reported in this work, 17 out of 18 sets of samples were collected on days when the HKO visibility is lower than 16 km. Therefore we believe that the HKO data could be used to approximate the visibility at HKUST.

We chose to use HKO visibility data by human observations over the forward scattering visibility sensor data at HKUST to be consistent with the visibility data used for the Guangzhou site, which is also based on human observations. Another reason is that measurements by visibility sensors do not consider the light extinction due to absorption by aerosols.

The following sentences are added to the text to explain why we use visibility measurements from HKO (Lines 126-132):

“The  $\sigma_{ext,obs}$  values at HKUST were derived from human visibility observations made at the Hong Kong Observatory (HKO), located 10 km to the east of HKUST. Comparisons of HKO visibility data and the measurement data by a forward scattering sensor installed at HKUST during the period of 1 January 2008 to 31 March 2009 indicate that the two sets of data are closely correlated. We here choose to use the human visibility observations at HKO on the consideration that the visibility sensor measurements do not reflect light extinction contributions due to absorption of light by aerosols.”

Comment 3:

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Another example is that the concept of the hypothetical particle (in subsection 3.3.1) which needs more validation or confirmation. In addition, it is essential to carry out more detailed sensitivity analyses on the values used in the calculation.

Author Response:

See response to comments 1, 2, and 8 by reviewer #1.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23021, 2009.

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