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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The fluorescence properties of aerosol larger than 0.8 µm in an urban and a PBA-dominated location" *by* A. M. Gabey et al.

Anonymous Referee #1

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We suggest a slightly abbreviated title "The fluorescence properties of aerosol larger than 0.8 μm in urban and tropical rainforest locations".

Given that the WIBS3 has a relatively small "needle" inlet tube with a flow rate of only 0.238 liter per minute, were any tests conducted to determine the potential losses of larger particles in the inlet tube? It would be good to clarify the dimensions of the inlet tube. Does the inlet ever partially plug during sampling and need cleaning?

We presume that N_{F1}, N_{F2} , and $N_{F3}$are concentrations of fluorescent particles: 1) in the 310-400nm band excited by 280nm, 2) in the 400-600nm band excited by 280nm, and 3) in the 400-600nm band excited by 370nm. This should be spelled out in the

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text.

We are a little concerned about the statistical significance of the concentrations of fluorescent particles as large as 8-20 micron because of the relatively low WIBS3 sample rate of 0.23 liter per minute. For the linear scales presently used in Figs 3 and 6, some of the size distribution plots for the concentration of particles contain essentially no useful data beyond 4 micron size. The form of the size distributions of both non-fluorescent and fluorescent particles for these larger particles might be more clearly evident if the (left) vertical scales in Figs. 3 and 6 were logarithmic. Logarithmic scales could also be used in Fig. 7, 8, and 9 for different reasons as discussed below.

The comparable populations of $N_{F1}$and N_{F2}particles in Manchester is consistent with the previous findings (Pinnick et al, 2004) that spectra of fluorescent particles (excited by 263nm light) in an urban aerosol (Washington DC, USA) have about equal populations that emit in the 300-400 nm region as compared to the 400-600nm region.

Regarding the discussion of the dependence of fluorescence intensity on particle size, it has been demonstrated that for moderately absorbing homogeneous spheres in the 1-10 μm diameter range, fluorescence intensity is approximately proportional to the square of particle diameter (see Hill et al, 2001). [Small weakly absorbing particles have intensity approximately proportional to the cube of diameter]. If the fluorescence data in Fig. 7, 8 and 9 were displayed on a log-log scale, the departure from intensity proportional to diameter squared would clearly be evident, and would be a more quantitative measure of a decreasing relative concentration of fluorors (or a transition to weaker fluorors associated with different composition) with increasing particle size.

The N_{F1} data for both Borneo and Manchester appearing in Fig 7 is duplicated in Figs 8 and 9; the N_{F3}data is duplicated in Fig. 8, and the N_{F2}data is duplicated in Fig. 9. The authors might consider combining figures 8 and 9 and eliminate the duplications.

In figures 8 and 9 the authors might consider plotting F1/F3 on a logarithmic scale.

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Although the summaries of WIBS3 data appearing in Figs. 3, 6, 7, 8 and 9 are interesting and informative, the results smear to some extent the information content of the single-particle data measured with the WIBS3 diagnostic tool. The authors might consider, either here or perhaps in a future publication, a principal component analysis approach where for each particle measurement a vector in a multiple-dimensional space is created, where one dimensional could be the elastic scattering signal, and other dimensions could be the various fluorescence channels (perhaps normalized by the elastic scattering). A principal component analysis might be a more powerful tool to better understand and interpret the WIBS3 measurements.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 531, 2011.