

Interactive  
Comment

## ***Interactive comment on “Black carbon measurements in the boundary layer over western and northern Europe” by G. R. McMeeking et al.***

### **Anonymous Referee #2**

Received and published: 30 July 2010

This paper presents some of the first measurements of black carbon (BC) aerosol mass over a wide domain in Europe based on in situ aircraft measurements. The measurements are put in context with total aerosol mass, total absorbing aerosol, carbon monoxide, and other species. The analysis provides substantial detail of the distribution and properties of BC up to 8 km and shows results that are largely consistent with previous observations at non-European sampling locations that have similar sources. The paper is on the long side, serving in part as a notebook of basic observational results from two airborne missions that will be the launching point for other follow-on papers cited extensively in the text. The paper is well-organized and well-written and care is taken to describe the analytical aspects of the measurements in supplemental material. I recommend publication after the authors consider a few comments.

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Introduction: suggest that the word ‘refractory carbon’ be used in describing what the SP2 measures in order to be adequately specific and to distinguish SP2 from other measurements of absorbing aerosol.

P13804 In 12+ There are two points to make clearer here: one is that the manufacturer’s calibration was not adequate. The calibration was improved by having access to the results from Kondo’s laboratory that are based on actual mass rather than inferred mass. Second, a missing point is to state the importance of knowing whether Aquadag represents ambient BC in terms of incandescent response vs BC refractory mass. These authors perhaps already know that Kondo’s group has found that this is not the case in Tokyo; fullerene soot better represents ambient aerosol by a large factor. These results are nearing publication. The authors must acknowledge this as an issue and are encouraged to see if the Kondo results are citable.

P13806 In 1 The sentence ‘The lower mass detection limit for the SP2 was determined by the laser intensity sufficient to heat particles to incandescence.’ is not correct in principle. Schwarz et al. 2010 as cited here demonstrates that incandescence of a particle alone is an unreliable indicator below a certain threshold that the mass vs incandescence relation is valid. Suggest restructuring this section to reflect this result.

Supplement p1. The phrase “(due to the power-law relationship between SP2 signal and BC mass)” needs a reference.

P3 Fig. 2. This is very odd behavior for an SP2 and likely reflects flawed components. Suggest explaining for the benefit of other SP2 users the origin of the strong peak height dependence of the ratio.

P4/5: Figs. 3 and 4. Is the vertical scale really mass? Ideally it would be.

Smaller points:

P13804 In 20: It is incorrect and disingenuous to describe NO<sub>x</sub> as those species that convert on a Mo catalyst. It is well demonstrated that a heated Mo catalyst generally

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converts more than  $\text{NO}_x = \text{NO} + \text{NO}_2$  but maybe less than  $\text{NO}_y$  in air masses influenced by urban and regional pollution. See reference below.

Nitrogen oxide measurements at rural sites in Switzerland: Bias of conventional measurement techniques, M. Steinbacher, C. Zellweger, B. Schwarzenbach, S. Bugmann, B. Buchmann, C. Ordóñez, A. S. H. Prevot, and C. Hueglin, *J. Geophys. Res.*, 112, D11307, doi:10.1029/2006JD007971, 2007

P13804 Clean up mixed tenses as A particle sampled by the instrument is illuminated by an intracavity Nd:YAG laser ( $\lambda = 1064 \text{ nm}$ ) with a Gaussian profile (TEM00 mode). If it contains sufficient absorbing material, the particle heats and reaches its incandescence temperature and emits thermal radiation, which is measured by two optical detectors. The peak intensity of the detected radiation signal is related to the mass of refractory carbon material and is insensitive to particle morphology or mixing state (Slowik et al., 2007).

Use of the general term ‘absorbing material’ here is incorrect.

P13805 In 11 Change to ‘Gaussian functions’

P13805 In 26 State what detector type is being used in this SP2.

P13828 In 7 Hendricks et al. aerosol model results could be cited here offering a limit on expected enhancements of BC mass from aviation, which are likely small.

Hendricks, J., B. KaÁrcher, A. DoÁpelheuer, J. Feichter, U. Lohmann, and D. Baumgardner (2004), Simulating the global atmospheric black carbon cycle: A revisit to the contribution of aircraft emissions, *Atmos. Chem. Phys.*, 4, 2521– 2541.

P13847 figure captions Captions do not describe the datasets represented, ie type of average, etc. Specifically Figs. 5, 8, 9, 10 would benefit from this information.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 13797, 2010.