Authors' response to the reviewers' comments

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Title: Spectral optical properties of long-range transport Asian dust and pollution aerosols over Northeast Asia in 2007 and 2008

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Reviewer #2 (Comments):

Authors appreciate the reviewer's constructive comments and suggestions. The manuscript has been revised to accommodate the reviewer's comments.

Answer to the reviewer's specific comments and questions;

Q: *Section 2.1, Lines 5-10: 1) Was the analyzer calibrated using an external calibration standard (i.e., sucrose spikes or methane injection), or did you assume that the manufacturer's internal standard calibration coefficient was correct?*

A: External calibration was performed monthly using known amounts of sucrose (4 points). Calibration constant was then updated based on the regression slope between measured TC versus true TC mass.

Following sentence has been inserted in page 5, line 25 as;
"External calibration was performed monthly using known amounts of sucrose."

Q: *Section 2.1, Lines 5-10: 2) Typically, for the purposes of QA/QC, some type of data comparison should be performed in order to validate the concentrations reported by the Sunset lab instruments; this often includes analysis of co-located filter samples. Is there any co-located data that can be used?*

A: Unfortunately, OC and EC from filter samples were not available during the measurement period. Instead, comparison study between our semi-continuous OC/EC analyzer and filter samples had been performed at an urban site in Beijing during the summer of 2006. The semi-continuous OC/EC analyzer was deployed at an urban site in Beijing, China during the

CAREBeijing2006 campaign (Jung et al., 2009a). 24 h quartz filter samples were also collected at the site for the determination of PM mass, OC, and EC (unpublished data). Good correlation was observed between semi-continuous and filter based OC/EC; i.e., OC with slope (x-axis: filter based, y-axis: semi-continuous) of 1.07 (R^2=0.86) and EC with slope of 0.94 (R^2=0.94).

Following sentences have been inserted in page 5, line 13 as;

"Comparison study between our semi-continuous OC/EC analyzer and 24 h filter samples was previously performed at an urban site in Beijing, China during the CAREBeijing2006 campaign (Jung et al., 2009a). Good correlation was observed between the semi-continuous and 24 h filter based OC/EC data; i.e., OC with slope (x-axis: filter based, y-axis: semi-continuous) of 1.07 (R^2=0.86) and EC with slope of 0.94 (R^2=0.94)."

Q: *Section 2.2, Lines 3-5: Although there is evidence to support that humidity does not affect Aethalometer BC measurements, the authors should comment on whether drying the aerosol might change its ambient optical properties; i.e., they should make clear whether there is evidence that water can/cannot enhance light absorption in internally mixed BC particles by optical focusing.*

A: Several studies address the effect of water uptake by aerosols on aerosol light absorption (Redemann et al., 2001; Nessler et al., 2005). Redemann et al (2001) estimated RH enhancement factors for absorption, χ(RH) (=b_{abs}(RH)/b_{abs}(dry)) of internally mixed soot up to 1.35 in the RH range of 30%−95% based on a core/shell aerosol model. Nessler et al (2005) estimated χ(RH) of internally mixed aerosols in summer (0.94 to 1.78) and in winter (0.84 to 1.53) in the RH range of 0%−99% based on a core/shell aerosol model. These studies demonstrated that the effect of water uptake by aerosols on aerosol light absorption was not negligible for internally mixed soot. Higher water uptake by quartz filter used in the aethalometer can further influence multiple scattering within the filter media and also shadowing effect, resulting in measurement error of the aethalometer. Thus, this study measured BC under dry condition. Chemical composition of coated shell of BC, size distribution of BC, and their exact mixing state are essential parameters for the core/shell aerosol model. Since those parameters were not measured in this study, RH effect on aerosol light absorption was not considered here.

Following sentences have been inserted in page 7, line 5 as;

"Several studies address the effect of water uptake by aerosols on aerosol light absorption (Redemann et al., 2001; Nessler et al., 2005). Redemann et al (2001) estimated RH enhancement factors for absorption, χ(RH) (=b_{abs}(RH)/b_{abs}(dry)) of internally mixed soot up to

1.35 in the RH range of 30%−95% based on the core/shell aerosol model. Nessler et al (2005) estimated χ(RH) of internally mixed aerosols in summer (0.94 to 1.78) and in winter (0.84 to 1.53) in the RH range of 0% to 99% based on the core/shell aerosol model. These studies demonstrate that the effect of water uptake by aerosols on aerosol light absorption is not negligible for internally mixed soot. Higher water uptake by quartz filter used in the aethalometer can further influence multiple scattering within the filter media and also shadowing effect, resulting in measurement error of the aethalometer. Thus, this study measured BC under dry condition. Chemical composition of coated shell of BC, size distribution of BC, and their exact mixing state are essential parameters for the core/shell aerosol model. Since those parameters were not measured in this study, RH effect on aerosol light absorption was not considered here."

Those references have been inserted in the reference section as;

"Nessler, R., Weingartner, E., and Baltensperger, U.: Effect of humidity on aerosol light absorption and its implications for extinction and the single scattering albedo illustrated for a site in the lower free troposphere, J. Aerosol Sci., 36, 958-972, 2005.

Redemann, J., Russell, P. B., and Hamill, P.: Dependence of aerosol light absorption and single-scattering albedo on ambient relative humidity for sulfate aerosols with black carbon cores, J. Geophy. Res., 106(D21), 27485-27495, 2001."

Q: *Figure 2: The authors should indicate in the caption what the error bars represent in order for readers to assess whether there are statistically significant differences between the BC/EC ratios*

A: BC/EC ratios in Fig. 2 are monthly average values obtained from hourly BC/EC ratio. Hence, error bars in Fig. 2 represent standard deviation (1σ) of BC/EC ratio.

The caption in Figure 2 has been revised as;

"Figure 2. Temporal variation of monthly average BC/EC ratio. Error bars represent standard deviation (1σ) of BC/EC ratio."