

## ***Interactive comment on “Ionic and carbonaceous compositions of PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1.0</sub> at Gosan ABC superstation and their ratios as source signature” by S. Lim et al.***

**S. Lim et al.**

meehye@korea.ac.kr

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1. Page 20529, line 25: the OC/EC ratios obtained are really low, and the authors state this could be due to a relatively higher EC concentration than OC in this study. What is the reason for this? this needs to be justified. These low OC/EC ratios are typical of heavy traffic sites in EU, very far from what would be expected at Gosan supersite.

The following sentence, “The difference in OC/EC ratios is likely due to relatively higher EC concentration than OC in this study area.”, just restates the lower OC/EC ratios but doesn't have any significant meaning. Moreover, EC concentrations were not high in this study compared with those of other studies. Thus, it will be cut out in the

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2. Page 20536, line 6: what does "reduced burning sources" mean? Even if mass concentrations are low, there could be a good correlation. Please clarify.

"In contrast, they were poorly correlated in summer ( $R^2 = 0.03-0.2$  for PM1.0, PM2.5, and PM10), which was likely due to reduced burning sources."

This sentence will be reworded as follows: "In contrast, they were poorly correlated in summer ( $R^2 = 0.03-0.2$  for PM1.0, PM2.5, and PM10), which was likely due to reduced sources, particularly from biomass burning and residential heating."

3. Table 4: this analysis should probably be done for the EC1/PM and EC2+3/PM ratios, not for the absolute concentrations, given that the absolute concentrations may be driven by other factors and not only by precipitation. If the non-rainy days were mostly strong advection days with low PM concentrations, or if conversely they were stagnation periods with high PM, the results would probably be very different. The authors could try this other approach.

It is noteworthy that sampling started on non-rainy day but samples were affected by heavy fog, drizzle, or weak rain during 24 hours of sampling period. Therefore, samples were not taken during summer monsoon season when there was heavy rainfall. We calculated this ratio (non-rainy days / rainy days) for the EC1/PM and EC2+3/PM and the result is given below. These ratios were higher for EC1 than EC2+3, which is similar in trend to the results of Table 4.

(Please see the supplement for the table below)

EC1/PM10	EC2+3/PM10	EC1/PM2.5	EC2+3/PM2.5	EC1/PM1.0	EC2+3/PM1.0	non-rainy/ rainy
0,96	0,83	1,28	1,02	1,09	0,91	

However, those ratios obtained from mass fraction were lower than 1 for EC2+3 in PM10 and PM1.0. While the absolute EC concentrations were higher during non-rainy days than rainy days, the ratios of EC2+3/PM were lower during non-rainy days than

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rainy days. As you mentioned, the absolute concentrations are determined by many factors including sources, chemical and meteorological factors during transportation, and removal processes.

In the study region, a strong advection usually occurs from winter to spring, during which PM<sub>10</sub> concentrations used to be highest with large amount of sulfate, carbonaceous compounds, and soil minerals (metal). Asian dust and associated pollution plumes are responsible for the high PM events. In the early summer and fall, on the other hand, stagnant conditions developed and made pollutants built up, during which mass concentrations (mostly fine mode) were enhanced. The removal by rain would lead to a greater reduction in coarse mode particles than fine mode particles where EC is more enriched. It would result in the lower ratio for PM<sub>10</sub> than for PM<sub>1.0</sub>. Likewise, the lower ratio of EC<sub>2+3</sub>/PM than EC<sub>1</sub>/PM indicates the smaller size of EC<sub>2+3</sub> particles than that of EC<sub>1</sub> and the longer residence time of EC<sub>2+3</sub> than EC<sub>1</sub>. The results using mass fraction agree with those using absolute mass in Table 4 and therefore, the discussion comparing the nature of EC<sub>1</sub> and EC<sub>2+3</sub> would be relevant.

4. - page 20537, line 7: "all air masses", statistical evidence needs to be provided to back this statement up.

We checked air mass back trajectories on all sampling days using both NOAA Hysplit model and the Lagrangian particle dispersion model FLEXPART. These showed the air masses arrived at Gosan from the east passing through South Korea or/and Japan and from the Pacific Ocean. Anyhow, "all" will be eliminated in the text.

5. - page 20540, line 25: "indicator of continental effects": if the ratio EC<sub>2+3</sub>/EC<sub>1</sub> is an indicator of continental effects, why is it lower than average for Beijing-typt air masses? This interpretation seems contradictory.

When the air mass was affected by continent, particularly Beijing, we found lower EC<sub>2+3</sub>/EC<sub>1</sub> ratio due to high EC<sub>1</sub> concentration. In contrast, when the air mass came from the Pacific with little influence by continent, higher EC<sub>2+3</sub>/EC<sub>1</sub> ratio was often

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observed. As we mentioned in the manuscript, EC1 and EC2+3 are very likely associated with char-EC emitted from smoldering combustion and soot-EC generated from higher-temperature combustion such as motor vehicle exhaust and coal combustion, respectively. Therefore, the higher (lower) ratios of EC2+3/EC1 indicate less (more) continental effect, which is how EC2+3/EC1 ratio serves as an “indicator of continental effect”.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/11/C11086/2011/acpd-11-C11086-2011-supplement.pdf>

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