

## ***Interactive comment on “Long-term observations of black carbon mass concentrations at Fukue Island, western Japan, during 2009–2015: Constraining wet removal rates and emission strengths from East Asia” by Yugo Kanaya et al.***

**Anonymous Referee #1**

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This paper by Kanaya et al. presents a detailed analysis of six years of black carbon (BC) measurements at Fukue, an island site in the East Asian continental outflow region. The authors used the observed BC/CO ratios under dry (non-precipitating) conditions to infer the emission ratio between the two pollutants from different regions in China, Korea, and Japan. They also observed lower BC/CO ratios when there was precipitation during transport, presumably reflecting wet removal of BC. A parameterization was provided for the relationship between the transport efficiency of BC and the accumulative precipitation amount along the transport pathway. Overall, this is a well-organized, well-written paper with some interesting and important results. The

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measurement and data analysis methods are sound and carefully designed. The results are fairly thoroughly compared with previous studies in region. The analysis on the wet-removal process for BC can potentially be very useful. I would recommend the paper be accepted for publication, after the comments below have been addressed.

Specific comments: Page 1, line 23: Is the CO mixing ratio under standard conditions? Why not convert mixing ratio to mass concentration? This would make it easier for direct comparison with emission inventories.

Page 2, Line 10: maybe briefly mention the health, air quality effect of BC here.

Page 2, Line 23: why are downwind measurements important for constraining emissions? One may argue that measurements made in the source region can be even more useful.

Page 2, last paragraph: some of the discussion on measurement technique may be moved to other sections, for example, section 2.

Page 4, Line 8: have the authors looked into some other emission inventories for comparison?

Page 4, Line 25: how does a change in the size-cut affect measurement results?

Page 5, Line 24: 2500 m seems to be a bit high, if the purpose is to investigate emissions from the source region. Some of the trajectories may not come close to the surface at all.

Page 5, Line 34: how was APT calculated, and what is the source of the precipitation data? Also since some precipitation is associated with relatively small-scale processes and strong vertical motion, how reliable are trajectories when precipitation occurs?

Page 8, Line 7: are the two ratios for Cape Hedo significantly different?

Page 8, Line 13: It is interesting (and surprising) that Korea has a higher BC/CO ratio than China, given my impression that Korea is in a more advanced stage of economic

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development than China. Any reason why?

Page 9, Lines 7-11. Northern China may have more centralized space heating that uses relatively large, more efficient boilers with smaller BC emission factors (compared with southern China).

Page 9, Line 14, the REAS2 Korean BC/CO ratio is greater than that for the domestic sector?

Page 13, Line 6, Figure 8b should be Figure 8a? Gray squares are not very easy to see in the figure. May consider using a different color.

Page 14, Line 18, is the decreasing trend for Japan statistically significant?

Page 15, Line 3, any measurements in Korea that may shed light on the BC/CO emission ratio from that country?

Figure 1: may consider using inventory BC/CO emission ratio for the map.

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