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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Regional variability in black carbon and carbon monoxide ratio from long-term observations over East Asia: Assessment of representativeness for BC and CO emission inventories" *by* Yongjoo Choi et al.

Anonymous Referee #1

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In this paper, Choi et al. analyzed black carbon (BC) and CO measurements at four remote/background sites in East Asia. They compared the measured BC/CO ratio with that from emission inventories, particularly the REAS inventory. They found that as compared with the measurements, BC/CO ratio in REAS is too high for Korea and too low for North Korea, probably due to certain emission factors in the transportation sector. They also conducted trajectory analyses to identify areas where emission estimates in REAS have large differences from measurements. Overall, this is an interesting study that provides some insights into the uncertainties of bottom-up emission

inventories for East Asia. The topic should be of interest to the atmospheric chemistry and aerosol research community. The paper is generally well organized. Writing will need some improvements but is mostly understandable. There are, however, a few major concerns that should be addressed before the paper can be accepted for publication in Atmos. Chem. Phys.

Specific comments: The authors claim harmonized BC/CO measurements but provide no evidence that the BC data are cross-validated between different sites. Have the authors conducted any side-by-side comparisons of the instruments involved? Can the authors provide an uncertainty estimate on the BC and CO measurements?

The authors used the 14-day moving 5th percentile to determine baseline CO. I wonder if the authors can elaborate more on why this criterion is selected. In particular, from Figure 2b, one can see some fairly sudden, large changes in the baseline from time to time. One would expect the baseline CO to be mainly affected by (small) sources and chemistry over large background areas and the changes should be gradual.

The authors compared measured BC/CO ratio with different emission inventories, but the focus is on REAS. Have there been any recent updates to REAS in recent years? It looks like 2008 is the last year for which REAS provides emission estimates. Given that measurements were mostly made in the 2010s and that East Asia has been undergoing fast changes in terms of emissions, would it be more useful to focus, instead, on emission inventories that have more recent estimates (such as EDGAR and MIX Asia)?

Technical comments: Section 2.2, it is not clear whether there is a size cut for EC/OC or MAPP measurements?

Table 2, from the table it appears that the baseline CO (difference between CO and deltaCO) is quite different between different sites, for example, between Gosan and Fukuoka. Can the authors comment on that?

Line 355-362: can the authors comment on what EDGAR may have done correctly to get a better overall comparison with measurements in terms of BC/CO ratio?

Line 375: have the authors tested other thresholds for trajectory altitude? Does the selection of this threshold have any impacts on the results? Figure 3: is the REAS mean (horizontal lines) weighted based on total emissions from each grid cell within the domain?

Figure 4: some of the seasons have few data points and the comparison may not be valid for those sites and seasons. Also please describe in the caption how the values for the squares are calculated.

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