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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of East Asian Summer and Winter Monsoon on Interannual Variations of Mass Concentrations and Direct Radiative Forcing of Black Carbon over Eastern China" *by* Yu Hao Mao and Hong Liao

Anonymous Referee #3

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This study used a chemistry transport model to examine the impact of monsoon variability on black carbon distribution (surface concentration, vertical profile and direct forcing as an integrated measure) over China. Since the emissions are fixed in the model simulation, metrological variability is the dominant sources of pollution variability. The results of this study generally support many empirical analyses that linked observed pollution level with monsoon variability as extensively cited in the paper. I found the analysis is comprehensive and the interpretation of the results is convincing. I recommend publication after the following issues are addressed.

One of my main concerns is regard to the interpretation of summer monsoon impact. It is noted by the authors " differences in âĂĺ transport of BC due to the changes in atmospheric circulation are a dominant mechanism through which the EASM influences the variations of JJA BC". However, the role of precipitation in setting wet removal is not adequately tested (e.g. excessive rainfall âĂİin strong monsoon year can increase wet removal flux and also contribute to pollution reduction). Of course, I admit that precipitation can also be correlated to circulation and moisture transport, so a deeper question would be How do you separate the effects of circulation (dispersion) vs. rainfall (removal)?

For wintertime, it is reasonable that circulation is the main cause due to lack of rainfall generally. However, in explaining the higher surface concentrations in weaker monsoon years, how do you separate the effects of (1) weaker horizontal transport that leads to higher total column loading of pollution buildup and (2) weaker vertical mixing that tends to put more pollution at the surface? Are these two processes working in the same direction or now? Which is more important in the model?

How do you account for the warming trends in the simulation years? Are the temperature/precipitation trends significant? Are they leading to trends in pollutions?

Minor points:

Page 1. Line 9. How do these affect "influence the variations of emissions"? Line 19. "convention" -> "convection"

Page 2. Line 24. This is just repeating the reference in page 1?

Page 4. Line 7. "matters" -> "matter"

Page 5. Line 5. What's a more appropriate reference here than Ramanathan and Carmichael (2008) is Ramanathan and Xu (2010). Line 11. It is odd to compare 1980-2010 forcing over Asia with 1850-2005 forcing globally.

Line 14. "Changes in monsoon"? But you did not provide references that monsoon was

indeed changing over EA. Line 22. If there is any statistical analysis on monsoon-BC relationship, they should be singled out and cited. Please check if any.

Page 7. Line 6. What are the scaling factors in use? Previous analysis have shown BC emissions are biased low, and adjustment has be made to better agree with AAOD (Bond 2013) or radiative forcing (Xu et al., 2013) estimates from observations.

Xu, Y., R. Bahadur, C. Zhao, and L. R. Leung (2013), Estimating the radiative forcing of carbonaceous aerosols over California based on satellite and ground observations, Journal of Geophysical Research: Atmospheres, 118(19), 11148–11160, doi:10.1002/jgrd.50835. Bond, T. C., et al. (2013), Bounding the role of black carbon in the climate system: A scientific assessment,. J. Geophys. Res. Atmos., 118, 5380–5552

Line 11. Do you have one run for each configuration? Or there is an ensemble of runs?

Page 8. Line 26. Could you comment on which is more reliable (if using NCEP as the benchmark)?

Page 16. Line 24. "summary" -> "summarize"

Page 19. Since these two simulations are previously described in separated papers, it is worth noting if they are identical except for the meteorological field.

Fig 8 and Fig 9. Statistical test of the difference should be conducted and reflected in the figure.

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