We would like to thank the referee for the thoughtful and insightful comments. We have addressed all of the comments. Our responses are itemized below.

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 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 in 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)?

Points well taken. Now the differences in wet deposition are included in Table 3 and the role of wet deposition is discussed in Sects. 3.3 and 4.3. "We also examine the impact of the changes in precipitation associated with the strength of the summer monsoon on BC concentrations, which is not as dominant as that of the winds. Compared to the strongest EASM years, increases in wet deposition of BC are found in the weakest monsoon years north of 28 °N in eastern China (Table 2), as a result of the high aerosol concentrations in the region and also the increased rainfall in the lower and middle reaches of the Yangtze River (around 30 °N). In the region south of 28 ° N in eastern China, we find decreased wet deposition of BC in the weakest monsoon years because of the less rainfall and low BC concentrations in that region. "
"Compared to the strongest EAWM years, enhanced wet deposition of BC are found in the weakest monsoon years in both northern and southern China (Table 2), likely because of the increased BC concentrations and precipitation in the corresponding regions."

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?

Included discussions in Sect. 4.3 “Compared to the strongest monsoon years, increases in upward mass flux of BC concentrations are found over 20–30 ° N and north of 40 ° N in the troposphere in the weakest monsoon years, confirming the increased surface BC concentrations in northern and southern China (**Figs. 4b** and **5b**).” “Weaker upward transport in the weakest monsoon years than the strongest years above 1-2 km in southern China (Fig. **7b**) is also not a dominate factor that contributes to the higher surface BC concentrations in the region (Tables 2 and 3).”

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?

Added discussions in Sect. 3.3. “We would like to point out that warming trend is not a significant factor to the variations of BC concentrations in the present study, as emissions are fixed at the 2010 levels and warming trend in the emissions are thus excluded. In addition, Yang et al. (2016) have systematically examined the trends of metrological parameters and $PM_{2.5}$ in eastern China for 1985–2005. They found positive trend in temperature and negative trend in precipitation while no significant trends in BC concentrations.”.

Minor points:
Page 1. Line 9. How do these affect "influence the variations of emissions"?

Added clarification in the parentheses “biomass burning emissions*”.*

Page 3. Line 19."convention" -> "convection"

Revised.

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

Deleted.

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

Revised.

Page 5. Line 5. What's a more appropriate reference here than Ramanathan and Carmichael (2008) is Ramanathan and Xu (2010).

Revised.

Line 11. It is odd to compare 1980-2010 forcing over Asia with 1850-2005 forcing globally.

Deleted.

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

References now included.

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

Added discussions "Zhu et al. (2012) showed that simulated summer surface BC concentrations averaged over northern China (110–125 ° E, 28–45 ° N) are ~11% higher in the five weakest monsoon years than in the five strongest monsoon years for 1986–2006."

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.

Added discussions "We have systematically evaluated the BC simulations for 1980-2010 in China from the GEOS-Chem model (Li et al., 2016; Mao et al., 2016). We would like to point out that simulated BC concentrations are likely underestimated because of the biased low emissions (e.g., Bond et al., 2013; Xu et al., 2013; Mao et al., 2016) and coarse resolution of the model used. We discussed the adjustment of the biased low BC emissions using the scaling factor in our previous study by Mao et al. (2016). The adjustment of the BC emissions is not included in the present study, as we aim to discuss the impact of variations in meteorological parameters on BC. "

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

runs?

Only one ensemble run for the configurations. Revised to “More details about the anthropogenic and biomass burning emissions of BC are discussed by Mao et al. (2016).”.“In each simulation, meteorological parameters are allowed to vary year to year, but anthropogenic and biomass burning emissions of BC are fixed at the year 2010 levels.”.

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

Added discussions “MERRA is likely more reliable than the previous versions of GMAO metrological data products (e.g., GEOS-4 and GEOS-5), as MERRA has significant improved the convection and then precipitation and water vapor (Rienecker et al., 2011) by comparing to the reanalyses.”

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

Revised.

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.

The details about the configurations of the two simulations are now included in Sect. 2.

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

The statistical analysis are included in Table 4 and the related Sects.3.4 and 4.4.