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## ***Interactive comment on “Source sector and region contributions to BC and PM<sub>2.5</sub> in Central Asia” by S. Kulkarni et al.***

### **Anonymous Referee #2**

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This manuscript describes modeling analysis of PM seasonal cycles, source type and region contribution, and future emission scenarios over Central Asia (CA). The WRF-STEM model is used to conduct a hemispheric scale simulation at 60km x 60km resolution. Observations at two surface sites in CA and AOD retrieved from MODIS are used to evaluate the WRF-STEM model prediction. The analysis is focused on the source attributions to PM in CA, suggesting dust and residential heating as two major contributors of PM for this region. Additional analysis is conducted on the impact of CA emissions on other regions of the Northern Hemisphere. Future emission scenarios for 2030 are adopted from the WMO/UNCEP report on short-lived climate forcers. Putting these emissions scenarios in the model, the authors find significant increase of PM and BC over CA if current legislation is kept unchanged for pollution abatement measures.

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Given little attention has been given to Central Asia, this paper represents new analysis. The paper is well written and well organized. It is suitable for publication in ACPD once several revisions have been made, as described below.

Major comments:

1. The model simulation and analysis are largely performed on the scale of the whole Northern Hemisphere, including other Asian regions with large emissions such as China, Europe, and North America. The emissions from CA will account for only a small portion of emissions in NH, thus the source attribution and long-range transport analysis will depend on the model's ability in capturing sources seasonality and abundance in other regions. However, the model evaluation is conducted only based on two surface sites in CA. Almost all the maps of model predictions shown in the paper are of the hemispheric scale, but such results are not evaluated nor do the authors discuss the uncertainties of them. The inconsistency between the scale of the model/results presented and the scale of the focused region is the main shortcoming of this paper.

2. In discussion of the emissions and future emission scenarios, it will be more informative for the readers to obtain a quantitative understanding of the emissions changes and the resulting changes in PM concentrations. I suggest the authors compile the results in a table, for example, listing how much BC emissions are increased in the current legislation scenario in 2030 and the resulting changes in BC concentrations. The table should be focused on CA. Currently these results are shown in the supplementary materials and by figures which are hard to read.

Minor comments:

1. pg 11357, line 21: % changed to percentage
2. pg 11357, line 26: "are" changed to "is"
3. pg 11360, line 8: remove "is" after in turn

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