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Interactive comment on "Regional modelling of polycyclic aromatic hydrocarbons: WRF/Chem-PAH model development and East Asia case studies" *by* Qing Mu et al.

Anonymous Referee #2

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PAHs are substances the can severely impair human health and ecosystems. However, still little is known about their fate in the environment, in particular in the atmospheric environment. By investigating the atmospheric transport of some important PAHs with the state-of-the art model WRF/Chem in China, a region where the pollution by PAHs is supposed to be significant, the authors provide an important contribution to PAH research. The physical-chemical processes they implement into WRF/CHEM are based on sound science. Also, the general setup of the model study appears sound to me.

However, I'm not convinced that the authors treat the PAH emissions - a crucial part of modeling studies - in an appropriate way. They use emissions of 2008 and compare

model results to measurements of 2013 and 2003. This only makes sense if PAH emissions did not change within this period. On the other hand, the authors convincingly explain the increasing relevance of PAHs in Asia due to rapidly increasing emissions. If the authors applied inter-annual scaling factors for modeling the years where the measurements were carried out, they should explain in detail how this was done. Otherwise, they should comment on this contradiction. An agreement with measurements alone could also be "right for the wrong reason".

For evaluating the model against measurements the authors compare arithmetic means and Pearson's correlation coefficients of time series, I assume (they don't mention it explicitly). In figure 3 and 5 one can see that the error bars reach negative values. This indicates non-normal distributions and statistical measures like arithmetic mean and standard deviations cannot be applied. The authors must check the distribution and decide based on this which measures to use.

The authors use expressions like "good prediction", "fair agreement", "significantly improved", ... to judge their model results. They should explain by which criteria they consider a result (an average or a correlation) as good or not good. As they didn't perform any statistical tests it seems to be pure opinion. I found only one statement where they explain their opinion: Compared with previous studies ... (page 10, line 4).

Minor comments:

page 1 line 29: To my knowledge the word "tracer" is used for inert substances (which PAHs are not). For substances in very low concentrations I would rather suggest to use "trace gases/compounds/substances".

page 2 line 27ff: the information of item 4 is included in item 1 and could be left away.

Figures 2c and 2d are not necessary because the authors explain in the text (page 6 line 32ff) why the transport behavior of trace substances is inherent to the model.

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