

## ***Interactive comment on “Impacts of historical climate and land cover changes on fine particulate matter (PM<sub>2.5</sub>) air quality in East Asia over 1980–2010” by Yu Fu et al.***

**Anonymous Referee #1**

Received and published: 1 June 2016

Overview:

The study presented by Yu Fu and coworkers investigates the impact of changes in climate, land-use and anthropogenic emissions on fine particulate matter, using the GEOS-CHEM chemistry-transport model to carry out simulations for two 5-year periods (1981-1985 and 2007-2011).

The manuscript is concise, clearly presented and well written and of real interest, giving an interesting analysis of changes in PM<sub>2.5</sub> over recent time slice. To clarify some of the aspects of the protocol and give a bit more perspective to this study, I would like the comments and corrections given below to be considered before the manuscript is published in ACP, which I strongly support.

C1

General comments:

I think that the title is misleading as “over 1980-2010” suggests that the whole 1980-2010 period is investigated and presented, showing for instance also interannual variability, while two 5-year periods (1980s and 2010s) are actually considered. The title should therefore be modified accordingly.

The reason for choosing 1980s and 2010s for the study should be clearly demonstrated. What makes this period so interesting to investigate PM<sub>2.5</sub> change in relation with land-use, climate or anthropogenic emission changes? Did strong changes in land-use occur in East Asia, in relation with management change? Were some important modifications of air quality regulations or industrial/human activities carried out? This would really help emphasizing the interest of choosing such a time line.

The close link with air quality is given in the title and clarified in the introduction but to me, the consequences of such changes in PM<sub>2.5</sub> on air quality and health should be commented more in details, at list in the conclusion and discussion sections. How do PM<sub>2.5</sub> levels for the different scenarios investigated compare with actual air quality thresholds (and what are the actual tolerance limits considered in East Asia)? This discussion could also be considered from both the human health and the vegetation point of view, as air pollution can be detrimental to both human beings and ecosystems.

The information regarding the fertilizer use, given in the conclusion and discussion section should also be given in the methods and model description. Please also detail which scenario was considered for fertilizer use, and the corresponding amount for the region of interest. Also, if a table giving the anthropogenic emissions for both scenarios, for a variety of key chemical species, is given in the supplementary material, no information is detailed regarding biogenic emissions of VOCs and NO<sub>x</sub>. And yet, those compounds are crucial considering the topic of the manuscript. Please also add a table, either in the main core of the manuscript or in the supplementary material, giving this information. When running the different simulations with GEOS-CHEM, at

C2

which time-step where emission forcings, especially regarding biogenic emissions were considered? Monthly or higher? As biogenic VOC emissions are characterized by a strong diurnal variability, considering emissions at lower resolution could also impact the results regarding air quality and PM<sub>2.5</sub> changes. This should be clarified and discussed.

Section 3, page 7, line 157: Please add some of the most important results from Zhang et al. (2012) for comparison.

Specific comments:

Abstract page 2, line 6: change “in northern China, but an increase in summertime” by “in northern China, but to an increase in summertime”

Page 3, line 11: change “would be useful to help better project” to “would be useful to help to better project”

Page 3, line 15: change “This attribution of East Asian air quality” to “This attribution of East Asia air quality”

Page 5, line 88: please write CTM in full, as used for the first time in the text Page 6, line 116: change “inputs, namely, leaf area index (LAI), and land” to “inputs, namely leaf area index (LAI) and land” removing commas

Page 7, line 157: change “Zhang et al ” to Zhang et al. ”

Page 9, line 207: change “uncertainties in not only” to “uncertainties not only in”

Page 9, line 234: change “but depending on region changes in wind speed” to “but depending on the region, changes in wind speed”

Page 10, line 236: something is missing in the sentence. “might have substantially enhanced or partly counteracted”. . . enhanced or counteracted what exactly?

C3

Page 10, line 237: change “the same patterns as that for sulfate” to “the same patterns as those for sulfate”

Page 10, line 245: change “Increased temperature also in part contributes” to “Increased temperature also partly contributes”

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-299, 2016.

C4