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Interactive comment on “The impact of land cover generated by a dynamic vegetation model on climate over East Asia in present and possible future climate” by M.-H. Cho et al.

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Response Letter for the Reviewer #3

We appreciate the comment for this manuscript. The comments of the reviewer and the corresponding corrections are listed.

General comments

The authors use a range of HadGEM2 simulations to investigate the impact of land cover changes and the related changes in dust on the East Asian climate. The study uses a similar design as ML12 comparing simulations with different processes turned

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on or off in the model. I would like to see a clearer description of how this study is different to ML12. It is for instance not clear to me if the same simulations are used. There are 17 figures in the manuscript, which seems to me a very large number to get a main point across. I got lost when trying to understand what the key points of the paper are. What are the main conclusions? The last paragraph seems to be very similar to the conclusions in ML12 and therefore I am not convinced if this study is adding any new insights. I suggest to decrease the number of figures and focus more on the main objectives.

Answer: Yes, the same simulations are used as in ML12, and much of the methodology is similar. However, the focus in the present study on the East Asian region, where possible future changes in monsoon rainfall are of crucial importance to a large population, is the reason for this second study. In addition, although the conclusions about the relative importance of the changes in surface conditions and the related changes in dust loading are similar for the two regions, the local and remote mechanisms for these are different. For South Asia, the role of the remote changes in land cover on e.g. spring snow cover, and the consequent change in the large-scale temperature gradient, was highlighted in ML12 for both present-day and future-present influences, whereas our results suggest more local mechanisms for the changes over East Asia. We have tried to include more information about this in the current paper to highlight the differences between the two studies and the main conclusions from the present one.

And we have reduced the 17 figures to 15 figures. The figure 9 has been removed and the figure 5 has put together into the figure 2.

And we have added to the discussion in section 3.1.2 in line 253-260 of on page 10, changing the last paragraph to add more information about the “no-dust” simulations in relation to ML12: And on page 12-13, line 333-337 And in the Conclusions, page 14, line 388-391

The first objective to investigate the physical influence of land cover and aerosols on

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the temperature and rainfall is addressed well, but the second objective about uncertainties is not. How is the uncertainty defined and investigated? I also expected a more elaborate discussion where the results are compared to other model and observational studies. For instance, how do the results relate to observational data of dust?

Answer: The results do not relate directly to observations of dust because we are investigating the possible effects of changes in dust loading that result from changes in bare soil fraction, not the actual contribution of dust loading to the climate of the region. We acknowledge that the changes in bare soil fraction, and the resulting changes in dust loading, in the model experiments are probably larger than are likely to occur in reality and that the results may be model-dependent, but they do suggest that such vegetation feedbacks may be important in the region and worthy of study in other models.

We now more clearly state in the Introduction that a major motivation for the study, in common with that of ML12, was to investigate the possible conflicting contributions to uncertainty in climate projections for the region from the inclusion of dynamic vegetation in a climate model (which ought to be beneficial) and its interaction with existing precipitation biases (which is detrimental). It is not possible with one modelling study to estimate the contribution of these model interactions to uncertainty in climate projections for the region; this can only be achieved through a systematic model intercomparison. Our aim is to encourage other modeling centres to undertake similar investigations as they incorporate additional Earth system processes into their models.

In response to these comments, we have attempted to clarify the objectives and motivation of the study in the Abstract, Introduction and Conclusions. It has been changed in lines 85-90 on page 4.

The comparison of the different models is interesting, but I suggest to improve the manuscript by being much clearer about the objectives and then addressing these, presenting only the key figures needed to support the main conclusions.

Specific comments

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Title: the title suggest a main focus on land cover, but the paper primarily deals with dust. Could you be more specific in the title about this?

Answer: The main focus of the study is on the changes in land cover, which affects both the surface fluxes and the dust emissions. In the current study, the role of the changes in dust emission that result from the changes in land cover is significant, although it is less dominant than in the South Asian region. In response to this reviewer's concerns, we have clarified the focus and aims of the study in the Abstract and Introduction.

The intention of the study was to examine the role of changes in land cover both through their effects on the surface conditions and through their impact on atmospheric dust loading. Although these are distinct processes, in terms of the dust we are focused on the changes in dust loading that are directly related to the changes in land cover, rather than on the general effects of dust loading of the atmosphere. We will try to clarify the motivation in the Abstract and the Introduction. Following reviewer's comments, we have changed the abstract in line 19-24 and line 78-79 in the Introduction. Line 205-207 in the Modeling results.

Please check the English grammar of the manuscript, I noticed quite some errors. Also make sure there is no text copied directly from ML12, as it seems to be very similar at some places.

Answer: The use of the same experiments and much of the same methodology as ML12 makes similarity of some of the text inevitable. However, we have tried not to copy anything directly. This has been checked and adjusted where necessary.

Is figure 5 the same as figures 6c with the only difference the scale?

Answer: No, Figure 5 shows the bias of AE against observations while Figure 6c shows the difference between AE and AEnod. This has been clarified in the Figure caption.

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Please also note the supplement to this comment:
<http://www.earth-syst-dynam-discuss.net/5/C663/2014/esdd-5-C663-2014-supplement.pdf>

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