

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

Comments: This paper analyzed the different roles of dynamical vegetation and dust radiative effects on the East Asia Summer Monsoon (EASM) with the HadGEM2 model simulations for present and future climate. This is an interesting view to compare the contributions of these two processes as the ML12, although they are two independent/distinct processes that controlled by different equations and schemes in the model system. I listed some specific suggestions for the authors:

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(1) The authors stressed two distinct processes impacting the EASM within the models system related to the land cover, i.e., the dynamical vegetation process and dust direct radiative effects. The authors mentioned that the DGVM simulated regional bare soil expansion causing dust loading and direct radiative effects, this might be one of the motivations of the work or connections of the two processes, it was not clearly expressed in the title and abstract, although their impacts on climate had been listed in the introduction. It would be better if the two processes are explicitly pressed, because they are two distinct processes in the model systems, which impact the climate through different ways.

Answer: 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 added the abstract in line 19-21 and line 78-79 in the Introduction. Line 205-207 in the Modeling results.

(2) The authors compare the relative contributions of the DGVM and dust radiative effect, which is consistent with the results of ML12 at the South Asian area. Besides the HadGEM2 family, are there any other model/observation studies to support the results?

Answer: ML12 mentions some studies in which the role of aerosols in the South Asian monsoon region has been investigated, and there are several studies examining the role of vegetation that are also mentioned in ML12. However, we are not aware of the relative contribution of these two aspects having been compared in other models or in observations. We will add to the summary of the current paper the suggestion that similar studies should be carried out in other models. Following the reviewer's comments, line 395-409 in the Summary and Discussion has been changed and added.

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(3) In the section 3.1.3, Fig.10, it seems that the radiative effects due to land cover changes (LCC) appear in the downstream areas of the LCC areas, is it common feature of the radiative effect, or model dependent?

Answer: This section and Figure discuss the radiative impacts of the dust changes resulting from the LCC, so it is reasonable that these should be seen downstream of the LCC themselves as the dust will be carried with the mean flow.

(4) In the DGVM of HadGEM2 family, if the crop is included? If not, I suggest the authors add some discussions about this, because although the crop might have some similar features as grasses/shrubs, but the evolutions of natural vegetation types are not enough to present those of crop, especially for the Asian, North American areas. Therefore in some model groups, the crop models are explicitly expressed (like in CLM4).

Answer: No, crops are not represented explicitly in the TRIFFID DGVM used in HadGEM2-ES. Crop and pasture are assumed to be a combination of C3 and C4 grass. Details of how the land use changes for CMIP5 were applied are in Jones et al. (2011; *Geosci. Model Dev.*, 4, 543-570, doi:10.5194/gmd-4-543-2011, 2011). Crop modelling for the MetUM is currently under development. We have added mention of this issue in line 148-151 on page 6.

(5) I agree that the DGVM and aerosol radiative effects are two important factors for the EASM climate, but from the view of the model system, they are both complex and the parameterization schemes in the model systems needs further developments, so the uncertainties of the models should be stressed in the discussions.

Answer: We have tried to stress in the Summary that these results are partly related to model systematic biases and also may be model-dependent and specific to the modelling system used. We have tried to highlight that, since these factors are important for climate and climate change in regions such as the EASM, it is important that model parameterizations simulate them correctly. We have made changes in the last paragraph

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to make this more explicit in line 395-409 on page 15.

Some technical questions: (1) P1320, the last line, reference "Bayer et al.", should be "Batlle Bayer et al."? Answer: Thank you for the comment, we have corrected.

(2) P1323, Line 4-5 of the 2nd paragraph, the references are duplicated. Answer: Corrected.

(3) P1323-1324, the author didn't introduce detailed information about the dust loading. Answer: We have added information about the dust scheme in the HadGEM2 family. Changes are in line 152-155 on page 6.

And the reference has been added Woodward, S.: Mineral dust in HadGEM2. Hadley Centre Technical Note 87, Met Office Hadley Centre., Exeter, EX1 3PB, UK, available from <http://www.metoffice.gov.uk/learning/library/publications/science/climate-science-technical-notes> (last access: 18 December 2014), 2011.

(4) P1354, Fig.14(b), the subtitle should be "Ts", not "T15"? Answer: Temperature at 1.5 m is correct.

Please also note the supplement to this comment:

<http://www.earth-syst-dynam-discuss.net/5/C659/2014/esdd-5-C659-2014-supplement.pdf>

Interactive comment on *Earth Syst. Dynam. Discuss.*, 5, 1319, 2014.

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