

## ***Interactive comment on “The influence of vegetation on the ITCZ and South Asian Monsoon in HadCM3” by M. P. McCarthy et al.***

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M. P. McCarthy and colleagues present a sensitivity study of the HadCM3 climate model to different reconstructions of vegetation. More specifically, they consider 9 transient experiments, covering the period 1959 to 1989 AC, initialised from previously published experiments covering the periods 1859 and 1989. Out of the 9 experiments, 8 use vegetation reconstructions meant to represent the pre-industrial vegetation cover (it is not entirely clear whether this is pre-industrial or pre-industrial potential vegetation), but obtained differently, either based on previously published surveys or on experiments with the TRIFFID vegetation model developed on purpose for HadCM3. The 9th experiment uses an estimate of extra-tropical vegetation at year 2100 obtained with TRIFFID, but maintains the tropical (or Southern Hemisphere?) vegetation of year

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1859, in order to emphasise the effects of northern extratropical vegetation changes on the atmospheric circulation.

A series of graphics are presented (Fig. 2, 3, 4) showing the effects of these vegetation differences on different atmospheric quantities, including temperature, precipitation, zonal wind and monsoon seasonal indices. The conclusion summaries nicely the objective of the authors: they “demonstrate a sensitivity of HadCM3 tropical climate to extratropical vegetation [...] consistent with numerous previous studies both with HadCM3 [...] and other GCMs. This study does not offer any new insight(s) into these teleconnections processes [...] but it serves to demonstrate how the representation of vegetation [...] can have significant implications. ”

This quote shows that the objective of the authors is to illustrate the climate-modelling uncertainties associated with vegetation land cover, not to investigate deeply the atmospheric teleconnection mechanisms, which have already been amply addressed elsewhere. Implicitly, it may be understood that the interest of the study lies in comparing these uncertainties with other sources of uncertainties, e.g., uncertainties associated with the uncertain parameters of the model, forcing and interannual variability, which are being sampled in the ensemble approach at the core of the 'QUMP' (Quantifying Uncertainties in Modelling Prediction) project. Unfortunately, such a quantitative comparison is missing in the present article.

It must be said that the discussion of mechanisms is being difficult by the nature of the experiment design. Changes in vegetation result from different modelling assumptions or different literature sources, rather than from a controlled alteration of vegetation patterns that would have been specifically chosen to study extratropical-tropical connections. In this sense the ensemble of experiments presented here is truly an 'ensemble of opportunity'. Namely, the authors observe that “ the weakening of the Tropical Easterly Jet further indicates a perturbation to the dynamical South Asian monsoon system rather than through vegetation feedbacks over India”, but how can one exclude that vegetation feedbacks over India force the weakening of the Tropical Easterly Jet?

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Keeping this in mind, one wonders whether the numerous plots presented in Figures 2 and 3 are the optimal way of presenting the information relevant for the present study. The reader is easily confused (implicit labelling of dashed, dotted and full solid curves does not help) given the complexity of vegetation changes (Figure 1) that have to be associated to temperature and precipitation changes (Figures 2 and 3). Furthermore, the plots do not provide much insight about which differences should be judged as significant as regards the other sources of uncertainties (in particular, parametric uncertainties).

The article may also gain in readability by considering the following comments about style. Introductory / review material tends to be intermingled with result discussion. The conclusion comments a bit surprisingly on the problematic of land use classification schemes, surely an important topic but which has not been addressed earlier in the article. It finishes on a quite general sentence that, arguably, is not very informative. The phrasing is confusing at places:

- the experimental setup has to be read several times, and shadows persist, as to the differences between TRIF1 and TRIF2, why TRIF1 and TRIF2 were used distinctly to run IGPB1, IGPB2 and WHS1 and WHS2, the difference between IGPB1 and IGPB2 being phenology fixed, while both TRIF1 and TRIF2 have phenology.
- which anthropogenic disturbances of vegetation are being taken into account?
- p. 94 l. 2 : 'with and without tropical vegetation' : what does it mean exactly?
- p. 94, l. 14 : 'intrinsic variability' : the authors probably mean the atmospheric variability
- by 'only perturbing the Northern Hemisphere': must one understand that the fraction of the tropics belonging to the northern hemisphere is being perturbed?

- how are TRIF1 and TRIF2 (and likewise, IGBP1, IGBP2 etc.) being ‘considered together’.
- When the acronym ‘TRIFFID’ is being re-introduced p. 97 l. 12, is it a typo for ‘TRIF’ ?
- p. 101 : ‘is therefore expected to have a positive impact on the strength of the South Asian Monsoon in that simulation’. The experiment was actually performed, isn’t it? so can’t the authors be more affirmative here?
- p. 98 l. 4; p. 93 l. 14, p. 101 l. 15: grammatical errors (‘s’)

In conclusion, the article has some potential as an interesting contribution about the effect of vegetation on climate but the purpose of the study has to be more consistently addressed, in particular by quantifying uncertainties that are meant to be considered here with respect to other sources of uncertainties quantified in the QUMP effort, and choosing figures more carefully, in line with this objective.

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