Earth Syst. Dynam. Discuss., 3, C283–C285, 2012
www.earth-syst-dynam-discuss.net/3/C283/2012/

Earth System Dynamics Discussions

Interactive comment on "The influence of vegetation dynamics on anthropogenic climate change" *by* U. Port et al.

C.D. Jones (Referee)

chris.d.jones@metoffice.gov.uk

Received and published: 14 August 2012

Review of Port, Brovkin and Claussen, "the influence of vegetation dynamics on anthropogenic climate change".

This is a well written, clear description of a set of experiments aimed at analysing the role of the physical and biogeochemical effects of natural vegetation changes in response to elevated CO2, and changes in climate. It is an important issue - more than 6 years after the C4MIP paper it is still very rare for coupled dynamic vegetation models within GCMs. There are very few papers in the literature that address the joint issue of the carbon uptake by vegetation changes and the biophysical effects of land-cover change. The subject matter is therefore certainly relevant to ESD.

As a general comment, I would like to see discussion of idea of "commitment" - much of the changes post 2100 are in some way committed - they are locked in due to existing emissions and climate change and cannot be avoided regardless of complete emissions cuts. Hence this raises the issue that mitigation and climate targets must take into account time horizons beyond the point of stabilisation.

my other main comment is that there appears to be a BIG change in the Sahara/Sahel precip maybe caused by the land-cover change there. The change is not necessarily in the MEAN, but is clear in the VARIABILITY which seems to get noticeably smaller when the vegetation changes. Is there an important issue to discuss here therefore that climate effects don't have to be on mean climate state, but can have important impacts through changes in variability. It would be wrong to state that the vegetation changes don't cause a climate change in this region.

specific comments: - page 489, line 17, "tree steps". Amusing typo!

- page 491. Here you should explicitly say that you don't consider anthropogenic land-use change. You mention this in the discussion at the end (by which time I had assumed it). But it should be up front in the methods.

- page 491, line 25 - when defining your regions of interest you might consider marking these on one of your maps.

- page 493, line 15. Not sure what you mean by this differs from Betts et al due to water stress? Betts et al also included the effect of CO2 on WUE. You might also cite Good et al (Good, Peter, Chris Jones, Jason Lowe, Richard Betts, Ben Booth, Chris Huntingford, 2011: Quantifying Environmental Drivers of Future Tropical Forest Extent. J. Climate, 24, 1337–1349.) who look at the climate and CO2 effects on future vegetation vulnerability.

- page 494, discussion of Sahel rainfall. Its hard to see the changes you discuss - can you also plot a smoothed timeseries? The variability change is also important as noted

above - so you should discuss that too? (e.g. changes in frequency of wet years? or dry years?)

- p.496, line 15. You say trees are less sensitive to CO2 fertilisation, but it could just be they have a longer response time, and you haven't seen the full response yet? In fact, how do you know by 2300 you are seeing equilibrium vegetation? would it change further if you ran to, say 2500?

- p. 497. The snow masking effect is clearly important, but a warmer climate might also have less snow. So have you separated the initial cause (snow masking) from an amplifying feedback (reduced snow)?

- p.500 - calculation of change in temperature - for small delta-T using a linear approach might work, but you could do this more rigorously using radiative forcing calculation (depends on log(CO2)). This might give you a slightly smaller value

- a final thought - we had some similar experiments which we never wrote up, but found that the response of vegetation and soil carbon were quite different between fixed and dynamic vegetation experiments and these offset. Have you looked at veg and soil carbon separately? they might be more interesting than the C_land total.

- figure 2 - can you use colours that are more different? its hard to spot DYN from STAT

- you do a lot of maps, which are informative, but can be hard to compare by eye. E.g. to compare figures 11 and 12 you could do a zonal mean plot which shows relative magnitude clearly. Likewise to compare figure 10 with fig 3.

Interactive comment on Earth Syst. Dynam. Discuss., 3, 485, 2012.