

Interactive comment on “Bergen earth system model (BCM-C): model description and regional climate-carbon cycle feedbacks assessment” by J. F. Tjiputra et al.

Anonymous Referee #2

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In this manuscript, Tjiputra et al. describe a new coupled climate carbon cycle model and analyse simulations performed over 1850–2100 with this new model. As previous studies that have used coupled climate carbon-cycle models (from Cox et al. 2001 to Friedlingstein et al, 2006), they also demonstrate a positive climate-carbon feedback. Then, they attempt to attribute this positive feedback to specific processes in the land or ocean carbon cycles.

While I think this new model could bring new and interesting insights into the carbon-climate retroactions, I do not feel the manuscript is precise enough, both in the description of the model and in the analysis of the simulations to be published in GMD without

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major revisions.

The main major comment I have is that the analysis somewhat mixes geochemical and climate effects on the carbon cycle. Already in the abstract, the fact that the ocean carbon fluxes are similar in the COU and UNC simulations does not tell anything about the climate-carbon feedback, contrary to what is wrongly implied by Tjiputra et al. Indeed, the 2 simulations have very different atmospheric CO₂ and one would have to correct for this if looking for climate effects on the carbon fluxes. Later, in the land analysis, the authors have followed the same analysis than in Friedlingstein et al. (2006), introducing beta and gamma factors. Such analysis is not performed for the ocean part and I found section 4.4 very confusing.

I have other major comments that I would like the authors to address:

1. Even if all components are described elsewhere, I found the model and simulations descriptions not very precise. Why is the GELATO model described if not used here? How is the model initialized? Is the model still drifting after 600 yrs?
2. The analysis of the land carbon cycle follows partly the method proposed by Friedlingstein et al; 2006. But I found the discussion of the gamma term too short. How are precipitation changing in the COU simulation? How does this affect land carbon uptake and the gamma term?
3. Again, I found section 4.4 very confusing. What are the beta and gamma values for the ocean component? I think this section needs careful re-organization.
4. This model yields one the largest climate-carbon feedback value when compared to Friedlingstein et al. 2006 11 models. Why is it so?
5. How do the model results compare to other models that use one or several of the components used here (LPJ, HAMOCC, ARPEGE...)? What do we learn from that comparison?
6. One big novelty here is that the ocean component is an isopycnic model. What

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are the implications (is the impact of stratification on air-sea carbon fluxes somewhat different to what other models predict?).

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