Review of Jeltsch-Thommes et al. ,

Jeltsch-Thommes et al., provide a new estimate of changes in land carbon across the deglaciation. This new estimate is obtained by finding the best fit between paleoproxy constraints and results of factorial simulations with the Bern3D Earth system model coupled to Monte Carlo ensemble.
Their results suggest that there was less land carbon at the LGM than during the Holocene. Their new estimate of deglacial change in land carbon is higher than inferred by recent studies due to the inclusion of sedimentary processes.
I recommend publication in Climate of the Past, granted the comments below are taken into account.

1) The estimate of land carbon change across the deglaciation given here is higher than previous ones due to sedimentary processes. Since land carbon and organic matter have similar d13C signatures, a deglacial increase in land carbon can be partly compensated by a decrease in organic carbon burial.
   It is true that in a pure mass balance approach these sedimentary might not be taken into account (even if after ~10k, these effects are not expressed fully, cf. Fig. 4). However, the model used here (Bern3D) includes a sediment model. Therefore changes in temperature, circulation, remineralization profile, etc… lead to changes in organic and carbonate burial. Sedimentary processes are therefore already taken into account in this modelling framework. I am thus confused by the inclusion of an additional "organic weathering flux". I can indeed imagine that an input of depleted d13C as would happen with a 100% increase in organic matter flux through river could significantly impact oceanic d13C. Maybe the rationale and numbers associated with the organic weathering flux should be explained in more details.

2) As a follow up on the previous comment, large parameters studies like this one are very useful to test the range of possibilities and derive statistics on possible parameter space. However, as a drawback, the solution can also include parameters that are not really realistic. This is hard to judge in the current state, since some parameters have been varied significantly and some additional description on all processes might be needed.
   For example, there might be some issues with which the changes in "Southern Ocean wind stress" are described. I think the authors start the LGM with weaker southern hemispheric westerlies, and these are linearly increased over the deglaciation. While Table 2 represents changes in parameter values across the deglaciation (e.g. a land carbon uptake of 445, 890 or 1335 GtC), the Southern Ocean windstress is marked as decreasing. This is also the case in Figure 7, with the notation (-10 to -60%), whereas, clearly the impact of increased southern hemispheric westerlies is shown. Same in the notation of Figure 9.
   P23, paragraph starting L.8: It might be easier to follow if everything goes in the sense of the deglaciation, i.e. describe an increase in the SO winds.

Similarly, due to changes in winds and sea-ice the Southern Ocean gas exchange should increase across the deglaciation.

A change in the remineralization profile across the deglaciation is fine, and remineralization would be expected to become shallower. However, it is not clear to me what is the rationale behind choosing “a linear profile”. In between which depths was the profile made linear?

Based on the “best guess scenarios” of the parameters space, what is the most plausible change in land carbon?

3) I am a bit surprised by the sign of the oceanic d13C change when the SO wind increases. From figure 9, it seems like the stronger wind does not increase deep ocean ventilation: Tschumi et al., 2011 simulates positive d13C anomalies in the deep Pacific.

4) In some of the experiments described in the manuscript it seems that global alkalinity changes. For example, p. 19, L.10: “a deglacial decrease in deep Pacific carbonate ions” is needed to explain the deglacial CO2 increase. Since [CO3]~[ALk]-[DIC], and since deep Pacific DIC is expected to decrease across the deglaciation, that means that the alkalinity must decrease more than DIC. Additional information on the magnitude and processes leading to the alkalinity decrease might be needed.

Minor points and typos:

- P3, L.32: please add “across the deglaciation”
- P4, section 2.1: A minimum information about the Bern3D is needed without having to go through the appendix: which components does the model include? What is the resolution of the model?
- P9, L.18: Please spell out “std”
- P10, para L. 14: This paragraph might need a bit of rephrasing. I think the argument of the authors here is that changes in Fe fertilization lead to changes in the oceanic organic matter content. These changes can somewhat be broadly included in the changes associated with “organic weathering” in their set of simulations.
- P27, L. 5: a parenthesis is missing
- P27, L. 8: “phosphorus”
- P29, L.5: “biogeochemical”