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Interactive comment on “A simplified permafrost-carbon model for long-term climate studies with the CLIMBER-2 coupled earth system model” by K. A. Crichton et al.

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To address the main points raised by reviewer 1:

Other statistical and empirical methods for modelling permafrost exist but thus far the role of permafrost in the carbon cycle is mostly modelled numerically, using the transition in soil depth from non-frozen to frozen to determine the active layer and therefore how much carbon is available to be decomposed. There are some studies which aim to project the future response of permafrost-carbon to changing climate, but these are not "dynamic" models so are not suitable for the application to paleoclimate studies (for example).

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The active layer can indeed not have a direct relationship to changes in permafrost coverage, because local conditions are important in determining the depth of the active layer. However, on the size of a CLIMBER grid cell there is a distinct relationship between the permafrost fraction of a grid cell and the mean active layer depth (from data). I will add the evidence for this to the revised manuscript and add to the discussion the implication of this upscaling/assumption.

I will add a clearer comparison for NPP modelled in CLIMBER and the other sources.

The reviewer mentions that a paragraph explaining how the different dynamic settings are attained is too long. However, I want to point out that carbon doesn't ever move from the slow to the fast pool, so perhaps I need to improve the paragraph to make it clearer. This may also be able to explain why the medium scenario has more carbon than the slow.

The choice of 40% of carbon in the top 1m of cryosols is from the findings of Tarnocai et al (2009), I explain this in the text.

Some problems with maps in figures, these maps appear clearly on the version I see. Perhaps they will appear properly for the reviewer in the revised version.

For the other comments, I will include them when making the revised version.

Thank you for your review.

Interactive comment on Geosci. Model Dev. Discuss., 7, 4931, 2014.

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