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Climate of the Past Discussions

Interactive comment on "Historical and idealized climate model experiments: an EMIC intercomparison" *by* M. Eby et al.

Anonymous Referee #2

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This paper by Eby and co-authors presents an inter-comparison of the results of a large number of earth system models of intermediate complexity (EMICs). It will undoubtedly be very useful especially for the upcoming IPCC report and presents and discusses the results in a clear, well written and concise manner. Although the findings in this paper clearly warrant publication I do however feel that before this is done the authors should do more to place the results presented in the wider context of other results within the field.

With this in mind I find the introduction a bit short and think that it could be substantially improved by including more about why EMICs are useful particularly in the context of the Last millennium. The problems and key questions about the last millennium should be detailed and why EMICs are a good tool to help solve them discussed.

Furthermore I feel that more could be done to compare the findings to past studies and results from GCMs. In particular I find the section discussing the pre-industrial period particularly weak. A comparison of the SAT results for the whole last millennium with the available CMIP5 simulations (or pre CMIP5 simulations eg Jungclaus et al 2010) (perhaps just by including the mulit-model mean CMIP5 results on figure 10) , would be useful . Alternatively some reconstructions are available globally for this period eg Mann et al 2009 so perhaps you could compare to them . At the moment the only comparison you make is for the MCA-LIA, but if the annual (or decadal) SAT variability is incorrect you could be getting the right answer but for the wrong reasons. In addition comparing the EMIC calculated values for the carbon cycle over the last millennium to the values obtained by GCMs (eg Jungclaus et al 2010) would be interesting to show whether the problems you discuss are applicable to all models or just EMICs.

The organisation of sections 3.3 and 3.4 should be made clearer . For example at the moment the effects of the forcings on SATs is discussed in two places. Where section 3.3 “Forcing Components” just refers to figure 7 which only shows the period 1850-2000 , section 3.4 the “freely evolving CO2” describes the effect of the forcings over the pre-industrial period. This should be combined somehow.

A few minor comments:

p4123 – line 25+ - should mention reconstruction uncertainty as well.

p 4127 – paragraph starting line 13 – Bit confusing. Should reword to make it clear that these are 7 individually forced simulations, one for each forcing included. 1 simulation with all forcings and 1 control simulation.

P4127 – line 24 – bit confusing – should reword for clarity. Eg one simulation included all the forcings and one simulation none of the forcings.

P4129 I feel that the headings like “climate” and “carbon” are a bit brief and generic, perhaps these could be expanded slightly to be a bit more specific.

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P4131 line 18 – should compare climate sensitivity results to previous studies.

P4132 line 10 change to “models with a complete”

P4136 line 28 –I think the description of the effects of volcanoes needs expanding. What do you mean by having a small overall effect? From figure 10 it looks like the they are having quite a large effect (they are causing multi-decadal temperature reductions see eg early 1800s), and indeed later in the paper you suggest that a part of the MCA-LIA transition is due to volcanic eruptions.

P4136 line 3-4 Can you compare these values eg effects of land use and aerosols to previous studies perhaps by GCMs.

P4141 line 25 Could mention that other land use schemes exist eg Kaplan et al 2010 which has larger pre-industrial land use change than the Pongratz et al dataset used here. And that potentially large land-use emissions due to reforestation in the Americas eg Ruddiman 2003, Faust et al 2006, Nevle and Bird 2008 for this period could be important (but see also Pongratz et al 2012).

Interactive comment on Clim. Past Discuss., 8, 4121, 2012.