

Interactive comment on “Harmonization of Global Land-Use Change and Management for the Period 850–2100 (LUH2) for CMIP6” by George C. Hurtt et al.

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Anonymous Referee #2 (Received and published: 6 June 2020) In their manuscript “Harmonization of Global Land-Use Change and Management for the Period 850-2100 (LUH2) for CMIP6”, Hurtt et al. present the methods used to create the LUH2 dataset – the detailed land cover maps used by the CMIP6 land surface models. The paper is well written and thorough, though it reads like a technical description (which is actually appropriate given the detailed methods required to understand the construction of the LUH2 dataset). I have only minor comments on the manuscript, and believe it is appropriate for publication in GMD.

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Line 50 – since the CMIP6 runs have already mostly happened, mentioning that here, and that this is a description/analysis of the land use patterns used by those simulations, would be appropriate (the authors mention it in the discussion).

> Good idea. We have added a line to the abstract that mentions that these simulations have already been performed and that this paper is documenting one of the inputs to those simulations.

Line 64 – typo: provided -> provide

> Fixed

Line 100 – I was confused about what GLM2 was, and what role it plays in LUH2. A bit of elaboration here on that would be helpful.

> We have now clarified this in the first paragraph of the Methods section.

Line 115/116 – drop “i.e.”

> Done

Line 120 – (equation 3) Please elaborate more on what equation 3 means. $m = f$, but the following sentence (lines 121-122) don't sound like $m=f$...

> Thank you for this feedback. We agree that this equation was somewhat confusing. We have now removed that equation and simplified the way in which we describe the cropland management vector within our system of equations.

Line 155 - At this point, the reviewer wonder's "How are changes in ice and water fraction accounted for?" Are no gridcells that are 100% ice projected to be less than that in the future? Or do those gridcells get to be "bare ground" under the ice, and models with dynamic ice sheet models can convert to the regular land model as appropriate, but just use gravel/bare ground as the ground cover? Or is there a chance for grass to grow on melted glacial sites in 100-300 years? Maybe this dataset assumes land ice is fixed temporally – if so, please state. If not please elaborate on how it is handled.

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> Section 2.1 already states that “The ice and water fractions of each grid cell were also taken from the HYDE dataset and were assumed constant over time.”

Line 203 - Is this because rice is the only C3 crop that is flooded? Is all rice in this dataset represented as flooded?

> Rice is the only crop we consider to be flooded. We do not represent total rice in our dataset – just flooded rice, due to its specific management characteristics. Non-flooded rice is possible but would be part of the remaining C3 annuals and is not represented explicitly, in the same way that wheat is not represented explicitly. We have added a line to Section 2.3 to clarify this.

Line 370 – Section 2.8 provided a very clear and useful walk-through of the land use in each SSP – I thank the authors for laying this out so clearly.

> Thank you

Line 695 - "these 12 states" -> which 12 states? Maybe say "the 12 potential states of vegetation cover used in this dataset..." (remind/help the reader)

> We have now added a line to the beginning of Section 3.1 to clarify this.

Line 728-730 - Elaborate on these three historical scenarios? (It feels a bit like they just showed up - if they were already introduced above it got lost in the details, and reminding the reader of what they are here would be helpful...)

> We have now added a brief description of the 3 historical scenarios in Section 3.1 as well as a sentence introducing them at the very end of the Introduction.

Line 740 – “Badge plots”: This is a minor comment, feel free to ignore it. I’ve never heard the term "badge plot" - I knew what it was when I looked at it, but have always heard of and referred to these plots as "circle network graphs" or "circle network diagrams". Putting “badge plot” into google didn’t pop up any figures like this.

> Upon investigation, the official name for these types of figures is “chord diagrams”

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and the term “badge plots” has now been replaced throughout the manuscript with the term “chord diagrams”.

Line 760-763 – This is quite interesting! At this point, I wanted to hear more about it. The authors actually discuss it more later.

> Thank you

Line 785 – Typo: “above- ground” -> “above-ground” (remove space after dash)

> Fixed

Line 788-789 – as mentioned above, it wasn’t entirely clear what the lower, baseline, and upper historical scenarios were.

> As described above we have now added a brief description of the 3 historical scenarios in Section 3.1 as well as a sentence introducing them at the very end of the Introduction.

Line 814 – Is this the same metric as used on Line 760? (If so, consider moving the two discussions to the same place - when I hit line 760 I wanted to know more about what it used to look like.)

> These metrics both deal with secondary mean age, however on line 760 we are discussing the globally averaged secondary mean age in years 2000 and 2015, whereas on line 814 we are discussing the range of secondary mean age values in the 1900s across all regions/continents. We have separated these two discussions into two different sections to highlight the global nature of our results (which are compared with diagnostic reference values), as well as the spatial-temporal nature of the underlying data.

Line 824 - tied to the above comment - secondary forest age is going up by quite a bit in RCP 8.5?

> Although RCP8.5 has the highest secondary mean age, these values did not vary

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significantly across scenarios, as mentioned in the manuscript. Line 936 - This is the list of datasets for Ma et al 2019 - maybe it is the same list, in which case no modification is necessary. If there is a separate list for this manuscript, then this link needs to be updated.

> Thank you for pointing this out. We have updated this section to refer to the actual GLM2 code archive used to generate the LUH2 datasets.

Figure 4 – Why the discrete drop in pasture-land after 2000? Cropland has a smoother transition from historical to projected land area.

> Pasture is typically more challenging to define consistently across models. We have now added mention of this when we discuss Figure 4 in Section 2.9.

Figure 5 – text is extremely small in subplot legends. Had to blow it up on the computer, and wouldn't be able to read it in print.

> These figures have now been updated, with the legends removed and described in the figure caption instead.

Figure 8 – as in Figure 5, text is too small to read

> We have updated these figures so that they are larger and no longer have the labels for the various land-use types. The colors representing each land-use type are now described in the figure caption.

Figure 9-14 – are these images blurry?

> Thank you for pointing this out. We have updated these images to improve their resolution, and they look much better now.

Figure 15 – legend text too tiny to read

> Thank you for pointing this out. We have updated these figures to increase the font size in the legends and the standardize the labeling.

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