Response to comments

Title: A 1 km global cropland dataset from 10000 BCE to 2100 CE

MS No.: ESSD-2021-219

Referee #1

General comments

Comment 1:

The contribution of the research is having produced the first 1km global cropland dataset with long time span by employing the newly developed spatially explicit allocation algorithms. The theoretical framework of the method is convincing, and the results are well presented. This spatiotemporally continuous dataset will provide a new opportunity for better understanding the past global changes caused by ALCC.

Response 1:

Thank you very much for the comments and suggestions. Please see the detailed point-by-point responses below.

Specific comments

Comment 1:

Although the new global cropland dataset has been created to such a high resolution (especially for historical periods), it is necessary to recognize the uncertainty of this dataset that was unmentioned in this manuscript. It is suggested to make a brief discussion further to address the issue that both the cropland area per capita estimated by HYDE and the historical population datasets adopted by this study are with huge uncertainty.

Firstly, the reviewer acknowledged that there is no more reliable cropland area data at the global scale than HYDE up to now, but it should be noticed that the historical cropland area data in HYDE have great uncertainty that has already been proved in many countries. One of the main reasons is due to the unreliable estimation of per capita cropland area. The continuous improvement of cropland area data in versions of HYDE mainly relies on the modification of the historical cropland area per capita curve according to the quantitative regional reconstruction results or other related indexes. Although the authors gave a clear definition of cropland (line 118), which was also the same as the definition adopted by HYDE during its historical cropland area estimation. The definition without considering the unignorable amount of fallow land or crop rotation in history would cause obvious underestimation about the cropland areas in some countries. Especially in countries that are far less intensively cultivated (completely different from the traditional agricultural period in China), like some countries in Europe. Some studies have also pointed out that the area of cultivated land in Europe in HYDE is obviously underestimated. Thus, this would cause a smaller extent of historical cropland distribution and lower fractions in the gridded allocation datasets.

Second, the historical population dataset of HYDE is actually derived from the national or subnational statistical/estimated population amount by downscaling method, which is basically the same as the allocation algorithm of historical cropland. The huge uncertainty also existed in this dataset caused by its allocation principles. Since both studies have adopted the population factor in the allocation algorithm of historical cropland, the difference of gridded datasets between HYDE and this study is namely caused by the different usage of physiogeographic factors and their resolutions during the allocation. In future related researches, please cautiously use this unevaluated historical population dataset.

Response 1:

Thank you for your suggestions. We supplemented more uncertainty analysis about the cropland area data in **Section 4, Paragraph 2**: "The cropland area estimation was very sensitive to them, especially the per capita curve shape. The curve construction cannot capture all specific contexts and special events in regional development. Based on credibility assessment using historical facts, regional reconstruction results, and expertise, research has pointed out the cropland area estimation errors in some regions such as Northeast China, North China, and some European countries (Fang et al., 2020)." and uncertainty analysis about population data in **Section 4, Paragraph 4**: "Except for the quantity limitations of variables, the quality limitations of these variable data also impact our results. For instance, the imperfect amount estimation and spatial allocation caused uncertainties of population data (Klein Goldewijk et al., 2017). However, there is no better available substitute. Other variables also have their own uncertainties."

Reference

Fang, X., Zhao, W., Zhang, C., Zhang, D., Wei, X., Qiu, W., and Ye, Y.: Methodology for credibility assessment of historical global LUCC datasets, Sci. China Earth Sci., 63, 1013–1025, https://doi.org/10.1007/s11430-019-9555-3, 2020.

Klein Goldewijk, K., Beusen, A., Doelman, J., and Stehfest, E.: Anthropogenic land use estimates for the Holocene - HYDE 3.2, Earth Syst. Sci. Data, 9, 927–953, https://doi.org/10.5194/essd-9-927-2017, 2017.

Comment 2:

Additionally, the cropland results are displayed at a global scale, so the details cannot be seen clearly, and no administrative boundary was added on the regional maps (line 635-640, Fig4-6, it would be better to add some necessary labels and administrative boundaries on the map; it seems that the linear unit scale should not be added under the geographical coordinate system?).

Response 2:

Thank you for your comments. We removed the linear unit scale and enlarged the font size of the latitude and longitude labels in **Fig. 4-6**, and we marked locations and coordinates of image center points in the figure titles:

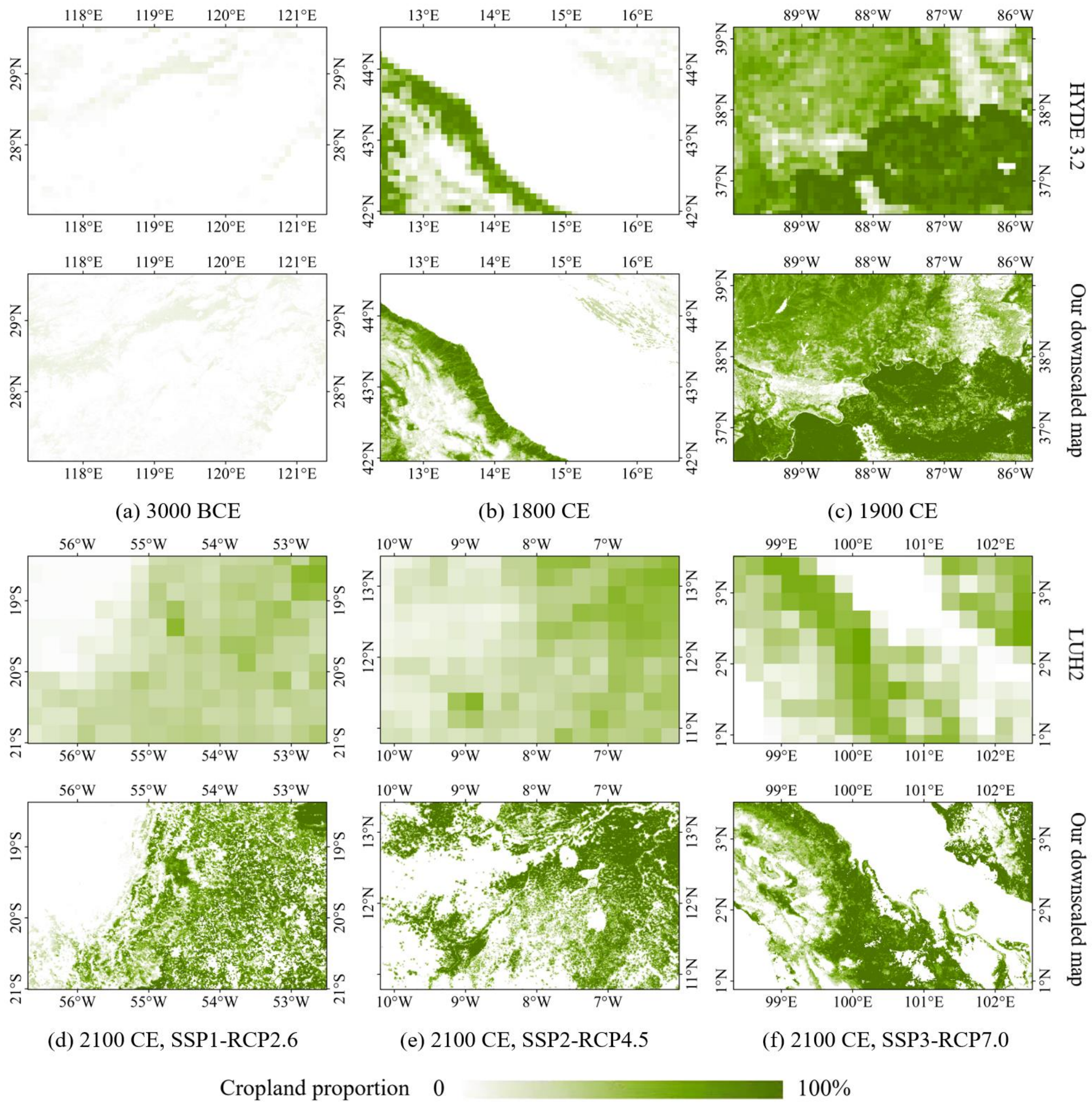

Figure 4: Visual comparison between our downscaled maps and HYDE 3.2/LUH2 for six different areas: (a)-(f). The locations of image center points are as follows: (a) Zhejiang, China (28.338°N, 119.321°E), (b) Adriatic Sea (43.272°N, 14.493°E), (c) Kentucky, America (37.846°N, 87.861°W), (d) Mato Grosso do Sul, Brazil (19.691°S, 54.599°W), (e) Koulikoro Region, Mali (12.105°N, 8.099°W), (f) Riau, Indonesia (2.199°N, 100.425°E).

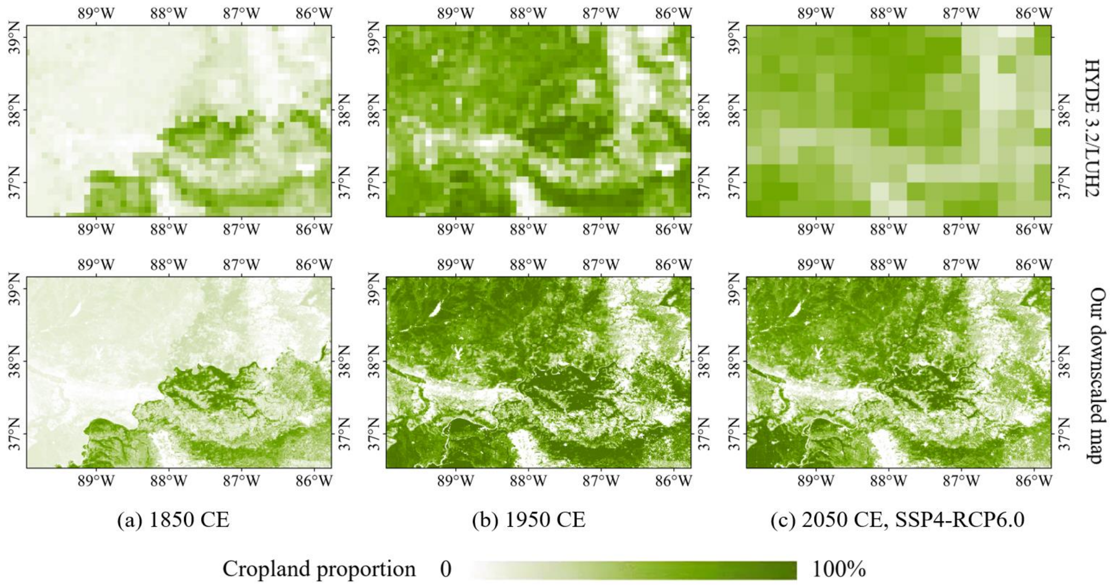

Figure 5: Cropland distribution of the region shown in Fig. 4c for different years: (a)-(c). The location of image center points is Kentucky, America (37.846°N, 87.861°W).

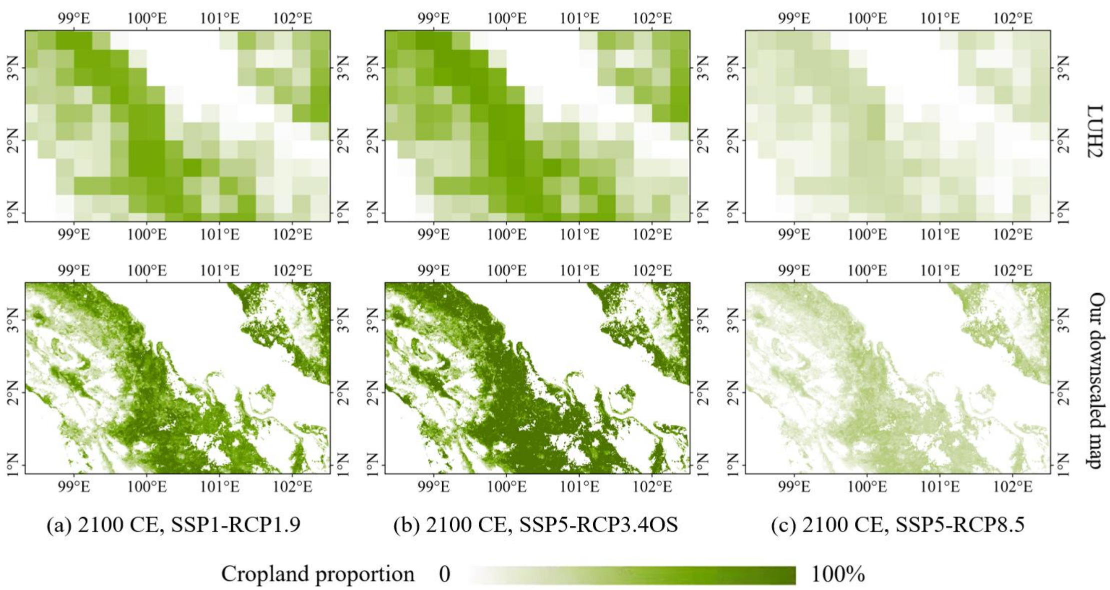

Figure 6: Cropland distribution of the region shown in Fig. 4f for different scenarios: (a)-(c). The location of image center points is Riau, Indonesia (2.199°N, 100.425°E).