Response to comments

Paper #: essd-2021-285

Title: GISD30: global 30-m impervious surface dynamic dataset from 1985 to 2020 using time-series Landsat imagery on the Google Earth Engine platform

Journal: Earth System Science Data

Reviewer #2

In this manuscript, the authors produced a global 30 m impervious surface dynamic dataset from 1985 to 2020 using the spectral generalization method and time-series Landsat imagery on GEE, and cross-compared the dataset with four existing global 30 m impervious surface products. The manuscript is well arranged, and the logic is clear. Even so, there are still some modifications need to be finished before it accepted. The following are the questions and some mistakes in this manuscript.

Great thanks for the positive and careful comments. The manuscript has been improved according to your and another reviewer's comments.

Line 130: What is the size of the areas where these data are missing? Whether the assumption that their land cover types remain unchanged will affect the accuracy of the final classification results.

Great thanks for the comment. According to our statistics, the proportions of missing Landsat observations in the first three periods (before 1985, 1986-1990 and 1991-1995) were 37.3%, 11.3% and 11.4%, respectively. The missing Landsat observations in the second and third periods (1986-1990 and 1991-1995) mainly concentrated on the Northeast Asia in which contained a small number of impervious surfaces, so the unchanged assumption had little effect in these two epochs. As for the first epoch, the missing observation areas covered the East Asia and the whole Oceania continent, so the assumption would affect the accuracy of final results. Our manuscript in Section 4.2 of accuracy assessment has also illustrated:

"However, the user's accuracy for the expansion of impervious surface after 2000 was higher than that before 2000, which was mainly affected by the sparser available Landsat observations before 2000 in Figure 1. Similarly, Gong et al. (2020) also found that the monitoring uncertainty before 2000 was greater than after 2000."

It should be noted that almost all time-series impervious surface products (including: GAIA, NUACI, GUD and GHSL) also used the unchanged assumption to monitor impervious surfaces in these missing Landsat observation areas.

Line 132: What do these numbers in the legend of Figure 1 mean? Do they represent the number of scenes in the images from different years? Why do not marked in the legend of the figure?

Great thanks for the comment. Yes, the numbers in the lower right of Figure 1 represented the available Landsat imagery from different years. Based on the suggestion, the figure has been revised as:

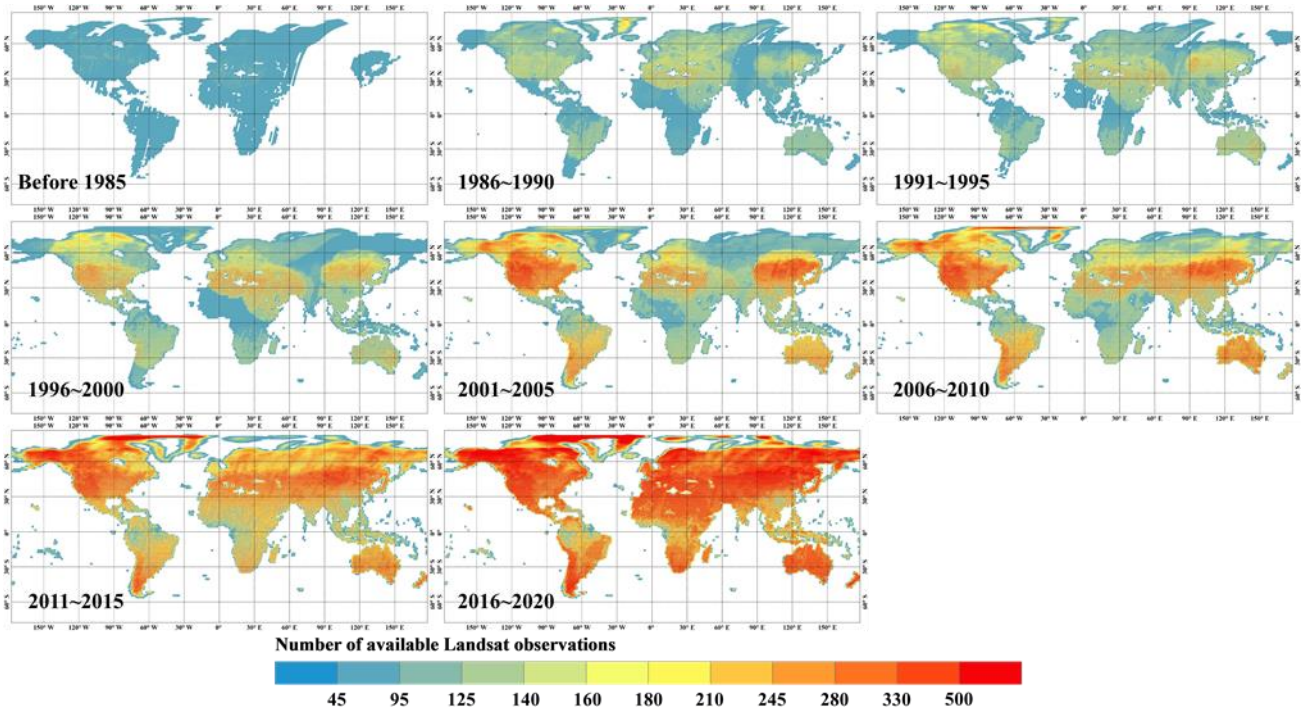

Figure 1. The spatial distributions of the available Landsat observations from 1985 to 2020, with 5-year intervals.

Lines 161~165: I do not understand this part of the text. What do you mean like 'the location of each validation sample in rural areas was moved to the center of the impervious object' With such a large sample set, how did you identify the validation sample in rural areas?

Great thanks for the comment. I am sorry that it was a litter confusing in explaining the collection of impervious surface validation samples. Actually, only a small amount of impervious validation samples in the rural areas was moved to the center of impervious objects for minimizing the effect of geometry error between the high-resolution imagery in Google earth and the Landsat imagery, because we found some rural impervious validation points in the boundary of impervious objects actually belonged to the pervious surfaces after projecting to the Landsat imagery. There was a total of 649 rural impervious surface samples have been moved according to our statistics. The part has been revised as:

"as the spatial heterogeneity of the impervious surface was usually higher than that of natural land-cover types, the impervious area in a 30 × 30 m window should comprise more than 50% when identifying impervious samples (Zhang et al., 2020). **Meanwhile, to minimize the effect of geometry registration between validation samples and our products, the geolocations of these rural impervious surface samples, located in the transition areas between the impervious objects (such as buildings and roads) and pervious objects, were re-positioned in the center of the objects.**"

The rules of how we identify the validation sample in rural areas were: 1) the size of impervious surface blocks (the rural areas were usually fragmented and smaller than the cities); 2) the land-cover distributions around the validation sample (the surrounding environment in the rural areas were usually the cropland, forest and grassland).

Lines 356~357: ‘we categorized the time-series impervious surface dynamic into 9 independent strata, including: pervious surfaces, impervious surfaces before 1985, and expanded impervious surfaces during 1990-1995, 1995-2000, 2000-2005, 2005-2010, and 2015-2020.’ Whether 1985-1990 and 2010-2015 are missing from the presentation.

Great thanks for pointing out the mistake. Yes, the 1985-1990 and 2010-2015 are missing in our presentation. It has been added in the revised manuscript as:

“as opposed to traditional period-by-period accuracy assessments, we categorized the time-series impervious surface dynamic into 9 independent strata, including: pervious surfaces, impervious surfaces before 1985, and expanded impervious surfaces during **1985-1990**, 1990-1995, 1995-2000, 2000-2005, 2005-2010, **2010-2015** and 2015-2020. We then calculated a comprehensive confusion matrix for these nine strata.”

Line 364: ‘Further, we selected three types of cities (mega-cities, tropical cities and arid cities)…’ Why choose these three types of cities to reveal the spatiotemporal dynamic.

Great thanks for the comment. The reasons why we choose three types of cities have been added in the manuscript as:

“we compared the time-series impervious areas of five products in six continents, and further analyzed the spatial consistency between GISD30 and five comparative datasets at the global scale. Further, we selected three types of cities (mega-cities, tropical cities and arid cities) and one rural area to illustrate the performance of five global 30 m impervious surface products used for capturing the spatiotemporal dynamic. **The reasons why we chose these types of cities and rural areas were that (1) the mega-cities usually experienced more intense urbanization, we could more intuitively understand whether there were commission error and omission error in each product; (2) the tropical cities usually mean sparser observations caused by the cloud coverage, so we could analyze the stability and robustness of each product in the tropical cities; (3) the arid cities were selected to analyze the ability of each product to distinguish between impervious surfaces and similar land types (arid soils); (4) the rural area contained sparse impervious surfaces and were prone to suffer the underestimation problem.**”

English writing needs to be further improved; some sentences are too long to affect the understanding of the article. The sentences can be broken down. e.g.: Lines 123~127, 127~131…

Great thanks for the comment. Based on your suggestion, the manuscript has been totally revised and then we will invite a professional team to carefully polish the revised manuscript again.

Line 22: ‘… similar to in …’ should be ‘similar to’?

Thanks for the comment. It has been revised and we have invited a professional team to carefully polish the revised manuscript.

Line 146: ‘…normalized difference water index (NDWI) and NDWI…’should be ‘NDVI’?

Great thanks for pointing out this mistake. It was corrected in the revised manuscript.