Comment on essd-2021-458
Anonymous Referee #1

This manuscript proposed an efficient method to produce the 10-m global impervious surface areas (GISA-10m) based on the existing ISA maps, Sentinel-1/2 images, and OSM data. Compared to existing global GISA products, GISA-10m can provide higher spatial resolution while keeping higher accuracy. The inter-comparison with existing datasets demonstrated the superiority of GISA-10m. Analysis of ISA on rural and urban areas further revealed the urbanization level and landscape of different countries in more details. In particular, an interesting point of GISA-10m is that it is able to delineate the area of roads across the world, making GISA-10m valuable for relevant urban studies. In general, this manuscript is well presented and makes novel contributions. However, some issues should be clarified to improve this manuscript. Specific comments include the following aspects:

1) In Section 3.1.3, the authors used 200 trees for training the random forest classifier, while the effect of the number of trees is not analyzed. Besides, the key parameter, e.g., the number of features used for training each tree, is not clarified. Please provide this information for better understanding.

2) Line 90: do you mean by "operating by"?

3) Line 103: relevant reference should be provided to support "the terrain distortion caused by the combination of two orbits".
4) L120: it should be "Landsat 8".

5) L121: I found both "GLCFCS" and "GLC_FCS" in the manuscript. Please explain.

6) Line 201: the original OSM data are provided in vector form. When this data was converted to 10-m raster, whether the majority rule was applied? The majority rule refers to "a pixel (10m × 10m) was labelled as ISA if more than half of its area was cover by ISA, otherwise it was identified as NISA". Please clarified this issue.

7) L295: why the total number of visually interpreted samples was 10800 when 200 samples were selected in 59 grids? Please check.

8) Section 3.3: it is better to move this section to Section 5.1, since the detailed discussion has been presented in Section 5.1.

9) Figure 6: is it possible to compare the continental accuracies of other datasets presented in Table 3? The comparison at continental level may give a clear difference of different datasets.

10) Figure 8: not much information in it.

11) Figure 11: it is better to use (a), (b), (c) to distinguish each subgraph.

12) Figure 17: this figure is not clear enough for presenting 30 grids. It is suggested to add legend and put this figure to the supplementary materials.

13) Line 372: “extracted” or “detected”?

14) Table 9: whether test samples used in Table 9 are from visually interpreted samples? Please clarify this.