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Interactive comment on "GLC_FCS30: Global land-cover product with fine classification system at 30 m using time-series Landsat imagery" *by* Xiao Zhang et al.

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It is good to see the study using time series Landsat to map global land cover and making the product public available. The classification legend is finer ($\sim$ 30 classes) than the currently available global 30 m land cover products. The training data are derived from the existing land cover maps (CCI_LC) and the Landsat time series temporal metrics were classified using random forest in the GEE platform. The product is validated using reference data collected from different sources for the validation of the existing land cover products and examined by the authors. Validation showed 82.5% overall accuracy in the 9-class level 0 legend and 68.7% accuracy in the $\sim$30 class

level-2 legend. Furthermore, the authors also make their global validation dataset public available, which could benefit other map producers.

I have a few comments on the clarification of the study. Many sentences are vague including the key information of the methodology.

Issue 1: It is unclear to me whether the training data reflectance comes from MODIS or from Landsat. This is the key of the paper. The term 'Global Spatial Temporal Spectral Library' sounds like the training reflectance is from the MODIS data. If the training data reflectance is derived from MODIS NBAR while the trained model is applied on Landsat surface reflectance, there will be some inconsistencies. Both the Landsat across scene viewing geometry variation and the Landsat and MODIS NBAR solar geometry difference will create inconsistency between MODIS NBAR and Landsat reflectance. MODIS NBAR is defined for local noon solar geometry and the Landsat overpass time is 10:30 am local time. Their solar zenith differences can be up to 20° depending on the location and time of the year. Furthermore, there will be spectral band pass difference between the two sensors.

Issue 2: Does the authors imply that the global land cover uses fine classification system in some region but uses coarse classification system in other regions? If so, please make it more explicit in the paper (abstract and conclusion) and clearer (what region uses fine classification system). This is important for users who consider to use the products. What is the CCI_LC coverage?

Issue 3: Something is wrong about no. of classes: "containing 30 land-cover types" and "(24 fine land-cover types)." Later on in Section 3.1, the 34 CCI_LC classes were "removal of four" and "three wetland land-cover types were further combined into one" so there should be 28 classes?

Issue 4: For the level-2 classification legend in Table 2, how the level-1 and level-2 classes can be used together for classification. For example, Deciduous broadleaved forest 60, Closed deciduous broadleaved forest 61, and Open deciduous broadleaved

forest 62 cannot be put together for classification. It is either 60 itself OR both 61 and 62. It cannot be all the three together in classification.

Introduction “stamping effect was noticeable” it is unclear what is stamping effect? Use the term which has been used in the literature.

Figure 1, the Landsat end overlap (row overlaps) cannot be considered as two observations.

Section 2.2 Define what is the GImpS-2015 product.

Section 3.1

This step is not conducted in GEE? The authors stated the Landsat data “were reprojected to the sinusoidal projection of MCD43A4.” The “metric centroid” algorithm is proposed in Zhang and Roy 2017 NOT by Roy and Kumar (2016). I don’t quite follow what is the purpose of the “metric centroid” algorithm since the training reflectance is derived from MODIS rather than Landsat. The “metric centroid” algorithm is used if the training reflectance is from Landsat and the training class label from MODIS.

3.2 Land-cover classification on the GEE platform Delete the comment on “Hughes phenomenon”. Hughes phenomenon is for certain classifiers. I don’t think it is still relevant for random forest given large number of training samples. The authors in fact admitted it by saying random forest “is less sensitive to noise and feature selection than other” classifiers.

Section 4 “the yellow marks in Table 5” there is no yellow mark in Table 5. Figure 7. What is the size of figure 7 a, b and c small areas?

Lines 470-475, I would suggest deleting this paragraph. This is a little aggressive.

5 Discussion It is good to see Figure 8. However, it is a little misleading. If Figure 8 only shows the number of training samples, why “where there are relatively uniform land-cover types, there are fewer training samples”. I would think the other way around.

For each 5 by 5 degree local training, does the authors also use some training samples outside the 3 by 3 tiles if there is insuffient samples in the 3 by 3 tiles? If so make it clearer in the paper.

“Therefore, it can be assumed that the training data derived from the updated GSPECLib were accurate and suitable for large-area land-cover mapping at 30 m.” If the GSPECLib’s contribution is only to identify homogenous locations, do not overemphasize in discussion or conclusion. Use something like derivation of training data from existing land cover products.

Line 525, “applied only for certain regions”, which region? Users deserve to know before using the data.

6 Data availability Make it explicit that the validation dataset is also public available. I believe it is an important contribution to the community.

7 Conclusion “global training data derived from GSPECLib”. It is a little misleading if the GSPECLib is only to identify homogeneous locations. Use something like derivation of training data from existing land cover products.

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