

Review

Earth System Science Data

Title: GCI30: a global 1 dataset of 30-m cropping intensity using multisource remote sensing image

Manuscript ID: Essd-2021-86

Based on the method tested in China and in a global framework (Liu et al., 2020, Liu et al 2020), this paper developed a global, spatially continuous cropping intensity map at a 30-m resolution (GCI30) using multi-resource satellite data from 2016 to 2018. Accuracy assessments were conducted with visually interpreted validation samples from Geowiki and in situ observations from the PhenoCam network, and they showed reasonably good agreement. The authors further carried out both statistical and spatial comparisons of GCI30 with 6 existing global CI estimates. They also explored the spatial heterogeneity of cropping intensity across countries, continents and Agroecological zones.

Indeed cropping intensity is a critical parameter in agricultural system and sustainable intensification in particular. Undergoing a global study like this is a huge project. The global coverage, very fine-resolution (30 m) and the latest time period (2016-18) indeed fills the data gap for achieving SDGs. However, I do have a few major concerns and I hope the authors could address them to make this paper not only publishable but also even more solid.

- (1) My biggest concern (I guess most readers too) is on the method of estimating cropping intensity (Section 2.3). This is obviously the core of this paper. The authors seem to take for granted that they could simply adopt Liu et al (2020) method and apply it to produce the global CI. (BTW, there are two Liu et al (2020), you should specify exactly which one you are referring in the paper). While I acknowledge the good quality of a peer-reviewed paper (or papers if you refer to both papers), there are at least two concerns: one is that what is the major contribution of this paper, or putting it more bluntly how to justify your publishing another paper if you already published two papers: one on China case study, another one on a global CI framework. You need to justify that. The other concern is that global cropping system has much more spatial heterogeneity than your China, or a few regional (in your global paper) cases. For example, subsistence agriculture in Africa (e.g. slash and burn) may include quite a few crops/vegetables within a year, or have fallow period extending multiple years. For many smallholder farmers, your 30m resolution is also too coarse This would not eliminate the mixed pixel problem you cited as one of the big advantage of a fine resolution. In addition, I don't know how Nfc(False crop cycle) is estimated in your method (Page 6, Line 6-9).
- (2) The authors divide the croplands into two categories by different mapping method, i.e. non-flooded cropland and flooded rice paddy. Due to the transplanting, flooded rice paddy is treated differently. Again the cropping system is quite diverse, there may have other cropping patterns or farming practices which also need special treatments. For example, the inter-cropping/mixed cropping of a staple crop with a pulse crop (e.g. millet and cowpea) in South Asia, and Sub-Saharan Africa is widely present. I suspect their vegetation indices would also be hard to distinguish and also need special treatment?
- (3) One of the important inputs is cropland extent. The authors integrated an ensemble of multiple land cover/cropland layer products. While I applaud the authors' effort of mix and match to try

to get the best available cropland extent globally, such an approach would create another problem of data consistency (e.g. different products even define cropland differently. Orchards are cropland? Plantain or coffee trees?). I suggest the authors look into Dr. Steffen Fritz work on global cropland. (You used Dr. Fritz' Geowiki datasets and I assumed you are familiar with his work).

- (4) Limited reference samples. The authors constructed two independent reference datasets, namely RDSat and RDsite, to evaluate the GCI30 performance. RDSat has 3744 sample records and RDsite has only 40. I understand the difficulty of obtaining the reference samples, particularly in a global study. And yet less than 4000 observations in a hugely diverse cropping system in the world is still quite limited.

In addition, there are many minor issues with expressions, or missing items. I listed some of them here:

- (1). Page 4 line 16-17: is there any reference to explain the gap-filling method?
- (2). Page 4 line 17: there are four reasons for invalid observation mentioned above (Page 4 line6), but here, authors just list one reason (i.e. clouds) for data gaps. In addition, "vacancy of cloud-free Landsat/Sentinel-2 observation", such expression may cause misunderstanding, whether "cloud-free" means satellite images without clouds or satellite images which were masked by mask algorithm?
- (3). Page 5 line 18: add references for GCC
- (4). Page 6 line 19: in reference Ding et al. 2020, it is more than 12% instead of 12%.
- (5). Fig. 2:
 - A. Please modify the font size of the horizontal axis label of Fig.2(a) or Fig.2(b) to ensure that the two graphs have the same font size.
 - B. Please modify the vertical axis scale interval of Fig.2(a) or Fig.2(b) to ensure that the two graphs are tidier.
 - C. "original phase" in Fig2(a), "flooding signal" in (b), "final phase" in (c), these three dashed polylines are all trapezoidal. But I think rectangular polylines can better represent different phases and transition points.
- (6). Fig. 5: please indicate the unit for the Area in the bar charts.
- (7) Page 11, Line 14: I don't see this (Wu et al., 2021) in your reference list
- (8). Page 12 line 16: shouldn't it be "top 9 countries"?
- (9). Page 13 line 7: shouldn't it be "South America"?
- (10). Page 14 line 14: change "to" to "two"?
- (11). Page 14 line 17: title of table 2. Shouldn't it be "four different studies"?
- (12). Page 15 line 15: according to Fig.8(B), shouldn't it be 32% (10%+22%)?

(13). There are many mistakes in reference section and in-text citations (almost all citation formats are incorrect), please check and modify according to the journal reference format requirements.

<https://www.earth-system-science-data.net/submission.html#references>