Response letter

Comments from the Editor:

The authors have addressed most of the reviewers' comments. Please address the comments from report #2.

> We sincerely thank the editor and reviewers for their precious time and recognition of our work. We have carefully addressed all the concerns raised by Reviewer #2 and made revisions to the manuscript accordingly. Please find our point-by-point responses to his/her specific comments below.

Comments from Reviewer #2

Accurate, detailed, and up-to-date information on cropland extent is crucial for provisioning food security and environmental sustainability. This study developed an annual cropland dataset in China (CACD) from 1986 to 2021 at 30 m spatial resolution by using Landsat TM/ETM/OLI images and a cost-effective cropland mapping framework.

The revised manuscript is well-written organized. It includes detail description about the mapping framework and some interesting findings derived from the new dataset. The CACD data has a relatively high accuracy, and also improved a lot spatially by comparing with previous cropland dataset (e.g., CLCD, CLUD). Overall, the CACD data is a good cropland extent dataset with fine resolution and can be applied to quantify the ecological consequences of cropland dynamics. Additionally, the authors have done a great job in response the comments from previous reviewers. A few more areas for improvement include:

> Thank you for your encouraging feedback. Incorporating your constructive suggestions, we have carefully revised our manuscript to enhance the clarity of the methods and discussion sections. Below, we provide detailed responses to each of your comments.

1. The definition of cropland is important in land cover mapping. In the revised manuscript, the author refines the definition of cropland as Joint Experiment of Crop Assessment and Monitoring (JECAM) network and adopts a shared scope of cropland that meets FAO's Land Cover Meta Language. To prove the reliability of the newly developed cropland data, the authors conducted a series of comparisons between five cropland datasets (i.e., CLCD, CLUD, GLAD, GFSAD) and statistical data. However, the definitions of these datasets are different, making it hard to conduct data comparison. I suggest adding a supplementary table of cropland definitions and discuss about it in section 3.2.

> Thank you for the valuable suggestion. We acknowledge that the varying definitions of croplands employed by these datasets may lead to potential bias in cross-product comparison. In response, we have added a supplementary table detailing the definitions used by each dataset (Table R1, corresponding to Table S5 in the supplementary materials).

Table. R1. Definitions of cropland in CACD, CLCD, CLUD, GLAD, and GFSAD.

Product	Cropland definition	Reference
CACD	Defined as a piece of land of 0.25 ha in minimum (minimum width of 30 m) that is sowed/planted and harvestable at least once within the 12 months after the sowing or planting date. This definition excludes: • Perennial crops like sugarcane and cassava • Fruit, tea, and coffee plantations • Greenhouse crops • Small plots such as legumes that do not meet the minimum size criteria of cropland	This study
CLCD	Defined as cultivated lands for crops. Including: mature cultivated land, newly cultivated land, fallow, shifting cultivated land; intercropping land such as crop-fruiter, crop-mulberry, and crop-forest land in which a crop is a dominant species; bottomland and beach that cultivated for at least 3 years.	(Yang and Huang, 2021)
CLUD	Defined as cultivated lands for crops. Including: mature cultivated land, newly cultivated land, fallow, shifting cultivated land; intercropping land such as crop-fruiter, crop-mulberry, and crop-forest land in which a crop is a dominant species; bottomland and beach that cultivated for at least 3 years.	(Xu et al., 2020)
GLAD	Defined as land used for annual and perennial herbaceous crops for human consumption, forage (including hay) and biofuel. Perennial woody crops, permanent pastures and shifting cultivation are excluded from the definition. The fallow length is limited to 4 years for the cropland class.	(Potapov et al., 2022)
GFSAD	Net cropland extent mapped was defined as the sum of the following agricultural croplands: • Cropland that is cultivated and harvested for food, feed, and (or) fiber, one or more times during a 12-month period; • Cropland that is left fallow, even when equipped for agriculture; and • Cropland that is permanently cropped with plantations (for example, orchards, vineyards, coffee, tea, and rubber). Notably, pasture land is not part of the cropland, except for alfalfa in the United States and some other countries.	(Thenkabail et al., 2021)

Noted both CLCD and CLUD were generated based on the China land-use/cover datasets developed by the Chinese Academy of Sciences, which encompassed six primary land cover classes (level-1) and 25 sub-classes (level-2) (Liu et al., 2014; Liu et al., 2005; Liu et al., 2003). Following Yang and Huang (2021) and Xu et al. (2020), we adopted their definition of cropland for the level-1 class.

In Section 2.7 (Lines 279-281), the manuscript has been revised as follows: "*It's noted that while all these products delineate cropland extents at a 30 m spatial resolution, they adopt inconsistent definitions of cropland (as detailed in Table S5). As a consequence, the cross-product results could potentially be biased, and we discussed this uncertainty in the limitations and prospects sections (refer to Section 4.3).*"

Moreover, we have discussed the uncertainty of the differences in cropland definition among products in the Discussion section of the revised manuscript (Lines 429-436), which is duplicated as follows: "*Lastly, it is crucial to acknowledge that the datasets compared in this study utilize diverse definitions of cropland (Table S5), potentially leading to discrepancies in cross-product comparisons. For instance, the cropland definition employed in this study excludes perennial crops, while GLAD includes perennial herbaceous crops. Additionally, CLCD, CLUD, and GFSAD may encompass lands cropped with plantations, such as fruits, coffee, and tea, which are excluded in this study (Fig. S1). Furthermore, GLAD and GFSAD incorporate fallow land (GLAD limits the fallow length to 4 years, as it operates cropland mapping on a four-year interval, whereas GFSAD was only mapped for 2015 and did not specify the duration of fallow). These variations in definitions may result in certain overestimation or underestimation of cropland extent across different products.*"

References

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Xu, Y., Yu, L., Peng, D., Zhao, J., Cheng, Y., Liu, X., Li, W., Meng, R., Xu, X., & Gong, P. (2020). Annual 30-m land use/land cover maps of China for 1980–2015 from the integration of AVHRR, MODIS and Landsat data using the BFAST algorithm. *Science China Earth Sciences, 63*, 1390-1407

Yang, J., & Huang, X. (2021). The 30 m annual land cover dataset and its dynamics in China from 1990 to 2019. *Earth System Science Data, 13*, 3907-3925

2. The cropland probability was estimated by using random forest model, but the description about how to conduct the model is not very clear. Was the random forest model trained at hexagon-level? If each hexagon has a unique random forest model, clarify it in section 2.3.

> Thanks for pointing out this issue. The random forest model was trained exclusively for each or each 0.8°×0.8° subregion (Fig. R2, corresponding to Fig. S2 in the supplementary materials). We have clarified this in Section 2.3 of the revised manuscript (Lines 187-188). It now reads as follows: "*In practice, we implemented a random forest model for each 0.8°×0.8° subregion (Fig. S2) using these parameter settings.*"

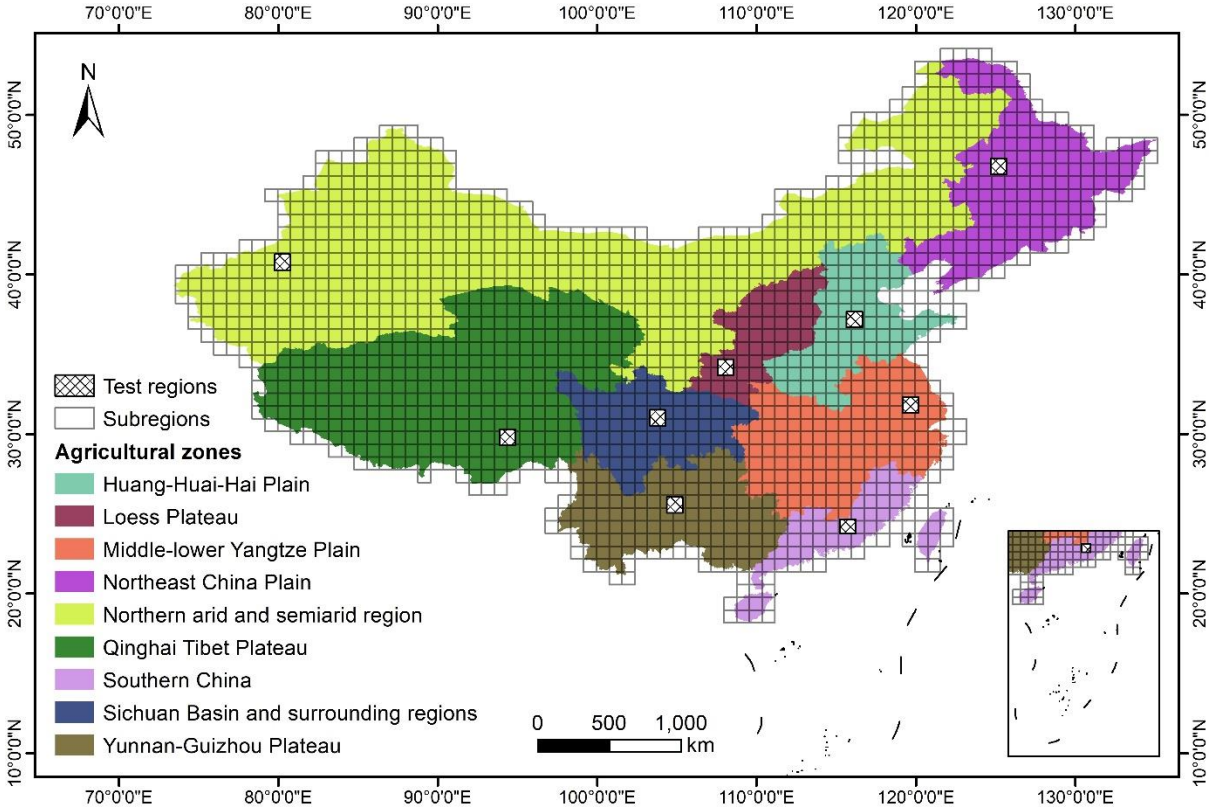

Fig. R2. Divisions of the study area. Annual cropland classification is performed within each 0.8°×0.8° subregion. Test regions with a size of 100 km×100 km are used to find the best LandTrendr arguments for each agricultural zone.