Response to Referee #2

We appreciate you very much for your comments concerning our manuscript entitled "A 30m resolution annual cropland extent dataset of Africa in recent decades of the 21st century" (MS No.: ESSD-2025-133). Those comments are valuable and helpful for improving our manuscript. We followed all comments and made revision and responses carefully. Revised portions are marked in *Orange* in the revised manuscript. The line, and figure numbers refer to our revised manuscript. And, a point-by-point reply to the comments are listed below.

Major concerns:

Q1. The training data incorporates multiple existing products, yet inconsistencies exist in their cropland definitions. How did the authors address the noise introduced by such definitional discrepancies?

A1: Thank you for this insightful question. To address the inconsistencies in cropland definitions across different products used for training, we first summarized the cropland definitions and corresponding class label numbers for each product in the revised Table 1. In our training data generation, the operational definition of cropland was closely aligned with the source products. Specifically, our cropland definition encompasses both rainfed and irrigated systems and includes cropland-dominated agroforestry systems with mixed vegetation, while excluding perennial woody plantations and greenhouse-covered lands. To further reduce noise and ensure temporal consistency, we incorporated the Continuous Change Detection (CCD) algorithm to help distinguish cropland from natural vegetation or abandoned land. Overall, our cropland product aligns with the FAO's general definition of arable land and temporary crops, while also reflecting the smallholder-dominated, mixed-use farming landscapes typical of African agricultural systems.

Q2. The Discussion section mentions the utilization of AFCD data for spatial mapping of abandoned cropland in Africa, which represents a highly meaningful endeavour. However, it should be noted that the authors did not specify how abandoned land was defined in this study. We recommend that the authors incorporate relevant descriptions regarding the operational definition of abandoned cropland.

A1: Thank you for your constructive comment. We agree that the definition of abandoned cropland should be clearly stated. In response, we have added a description to the manuscript clarifying that, following the FAO definition, land is considered abandoned when previously cultivated cropland remains idle for more than five consecutive years.

We have updated the text in Line 391 to clarify this definition:

"*… the area of abandoned cropland also rose. According to the FAO, cropland abandonment refers to formerly cultivated land that has not been used for agricultural production for a period exceeding five consecutive years. By 2018, abandoned cropland …*"

Q3. The Geo-Wiki sample (Laso Bayas et al., 2017) is based on 300m PROBA-V imagery, but AFCD is a 30m product. Does this scale difference lead to validation bias?

A3: Thank you for your insightful comment. Although our AFCD product has a spatial resolution of 30 m, the Geo-Wiki cropland dataset provided by Laso Bayas et al. (2017) accounts for scale compatibility by subdividing each 300 m × 300 m sample into a 10 × 10 grid of 30 m cells. These cells, matching the resolution of our product, were visually interpreted by multiple participants. The final cropland proportion per 300 m grid was aggregated from these 30 m interpretations, with the median value across at least three independent annotators used to reduce individual subjectivity. During validation, we aggregated our product to the 300 m scale to align with the reference data.

This approach is consistent with established validation practices. Notably, Waldner et al. (2019) demonstrated the applicability and reliability of the Geo-Wiki dataset for validating 30 m binary cropland maps such as GFSAD and GlobeLand30. Similarly, Nabil et al. (2020) employed a comparable method by estimating cropland percentages within 300 m × 300 m areas based on counts of high-resolution cropland pixels. Given that the Geo-Wiki reference data originates from 30 m-level interpretation and has been validated in previous studies, and considering our use of resolution-aligned aggregation, we believe that the scale difference does not introduce significant bias in our validation.

Reference:
Laso Bayas, J. C., Lesiv, M., Waldner, F., Schucknecht, A., Duerauer, M., See, L., Fritz, S., Fraisl, D., Moorthy, I., McCallum, I., Perger, C., Danylo, O., Defourny, P., Gallego, J., Gilliams, S., Akhtar, I. ul H., Baishya, S. J.,

Baruah, M., Bungnamei, K., Campos, A., Changkakati, T., Cipriani, A., Das, K., Das, K., Das, I., Davis, K. F., Hazarika, P., Johnson, B. A., Malek, Z., Molinari, M. E., Panging, K., Pawe, C. K., Pérez-Hoyos, A., Sahariah, P. K., Sahariah, D., Saikia, A., Saikia, M., Schlesinger, P., Seidacaru, E., Singha, K., and Wilson, J. W.: A global reference database of crowdsourced cropland data collected using the geo-wiki platform, Sci. Data, 4, 170136, https://doi.org/10.1038/sdata.2017.136, 2017.
Nabil, M., Zhang, M., Bofana, J., Wu, B., Stein, A., Dong, T., Zeng, H., and Shang, J.: Assessing factors impacting the spatial discrepancy of remote sensing based cropland products: a case study in Africa, Int. J. Appl. Earth Obs. Geoinf., 85, 102010, https://doi.org/10.1016/j.jag.2019.102010, 2020.
Waldner, F., Schucknecht, A., Lesiv, M., Gallego, J., See, L., Pérez-Hoyos, A., d'Andrimont, R., De Maet, T., Bayas, J. C. L., Fritz, S., Leo, O., Kerdiles, H., Díez, M., Van Tricht, K., Gilliams, S., Shelestov, A., Lavreniuk, M., Simões, M., Ferraz, R., Bellón, B., Bégué, A., Hazeu, G., Stonacek, V., Kolomaznik, J., Misurec, J., Verón, S. R., De Abelleyra, D., Plotnikov, D., Mingyong, L., Singha, M., Patil, P., Zhang, M., and Defourny, P.: Conflation of expert and crowd reference data to validate global binary thematic maps, Remote Sens. Environ., 221, 235–246, https://doi.org/10.1016/j.rse.2018.10.039, 2019.

Q4. Some of the abbreviations are not explained in detail when they first appear (e.g. LGRIP, CCDC) and it is suggested that the full names be added.

A4: Thank you for pointing this out. We have added the full names of the abbreviations, such as LGRIP and CCDC, upon their first appearance in the manuscript, to improve clarity for readers.

Q5. The terms "cropland" and "farmland" are used interchangeably in the text, and it is suggested that they be standardised as "cropland".

A5: Thank you for pointing this out. We agree that consistent terminology improves clarity. Accordingly, we have standardized the terminology throughout the manuscript and now use the term "cropland" exclusively instead of using it interchangeably with "farmland".

Minor concerns:

Q1. Title: "recent decades of the 21st century" Vague (suggest clarification of year range)

A1: Thank you for your suggestion. In response to the comment and in line with Referee #1's recommendation, we have revised the title to "*An Annual Cropland Extent Dataset for Africa at 30m Spatial Resolution from 2000 to 2022*" to clearly indicate the temporal coverage of the AFCD product.

Q2. The abbreviation "SDG" should be defined at its first occurrence in line 43, rather than being introduced later in line 54.

A2: Thank you for your suggestion. We have added the full term "*Sustainable Development Goals (SDGs)*" at its first occurrence in line 43.

Q3. In Line 25, redundant "for Africa" (appears twice).

A3: Thank you for your suggestion. We have removed the redundant phrase “for Africa” in line 25 to improve clarity.

We have updated the text in Line 26:

"*The study developed a 30-meter resolution African annual cropland distribution (namely AFCD) dataset spanning the years 2000 to 2022.*"

Q4. In Line 41, "croplands play is of critical importance" → "croplands plays a critical role"

A4: Thank you for your suggestion. We have corrected the sentence in line 42 to: "*croplands are of critical importance to global food sustainable development …*"

Q5. In Line 55, "one in five people undernourished" → "one in five people was undernourished"

A5: Thank you for your comment. We appreciate your suggestion. However, we believe the original phrase “with one in five people undernourished” is grammatically correct and commonly used in scientific writing to express a current condition. Therefore, we have retained the original phrasing in the revised manuscript.

Q6. In Line 76, "GCEP" is undefined and potentially mis-cited (Xiong et al., 2017b refers to GFSAD, not GCEP).

A6: Thank you for pointing this out. We acknowledge the miscitation and have corrected it. The revised sentence now reads:

"*While specialized cropland products, such as the Landsat Global Cropland Extent (Potapov et al., 2022), GFSAD Landsat-Derived Global Rainfed and Irrigated-Cropland Product (Teluguntla et al., 2023), GFSAD Global Cropland Extent Product (Thenkabail et al., 2021), and Digital Earth*

Africa (Burton et al., 2022), offer high spatial resolution (ranging from 10 to 30 meters), allowing for detailed landscape characterization."

Q7. In Line 97, duplicate use numeric (2).

A7: Thank you for your observation. We have corrected the redundant numbering in Line 97 to ensure consistency and clarity in the text.

Q8. In Line 136, "samples were randomly selected for further validation by students and experts" is vague.

A8: Thank you for your suggestion. In response, we have revised this part of the manuscript to provide a clearer explanation of the validation process, including how the samples were selected and assessed by trained students and domain experts, as also suggested by Referee #1.

Q9. In Line 142, "combines" should be "combined".

A9: Thank you for your suggestion. We have corrected “combines” to “combined” in Line 153 accordingly.

Q10. In Line 177, the third-level heading "3.3.1" should be corrected to "3.2.1"; revise Line 199 to "3.2.2" and Line 223 to "3.3” for consistency.

A10: Thank you for your suggestion. We have corrected the section numbering as follows: “3.3.1” to “3.2.1” in Line 221, “3.2.2” in Line 245, and “3.3” in Line 274 to ensure consistency throughout the manuscript.

Q11. In Line 208, delete "first".

A11: Thank you for your suggestion. We have deleted the word “first” in Line 208 to improve clarity and avoid redundancy in the sentence structure.

Q12. In Line 210 (Equation 1), there appears to be an extraneous "&" symbol that may be a typesetting error. Please verify the mathematical expression's integrity and ensure the formula complies with standard notation conventions.

A12: Thank you for your careful review. We have corrected the typesetting error in Equation (1) by removing the extraneous "&" symbol to ensure the formula adheres to standard mathematical notation.

Q13. In Line 252-254, "The result of this study is developing a new annual cropland dynamic map of Africa at 30-m (Fig. 5). The visual evaluation of the current cropland product shows that cultivated areas are accurately represented across diverse agricultural landscapes throughout Africa (Fig. 5). As shown in the figure above, …" The redundant repeated descriptions of Figure 5 in the text may disrupt the flow; consider consolidating them to strengthen the paragraph's logical coherence.

A13: Thank you for your valuable suggestion. We have carefully revised the paragraph to eliminate redundant references to Figure 5 and improve the logical flow of the text. The updated version reads:

"*The outcome of this study is an annual 30-m cropland dynamics map for Africa (Fig. 5), which demonstrates strong performance in capturing cultivated areas across diverse agricultural landscapes. As illustrated in Figure 5, five representative regions were selected to evaluate the AFCD's capability in recognizing varying cropland patterns under different agricultural conditions.*"

Q14. In Line 304 (Figure 6), The plot elements of the red and blue dots and the purple line should be explained.

A14: Thank you for your suggestion. We have revised the caption of Figure 6 to provide clearer explanations of the plot elements. The updated caption reads:

"*Comparison of AFCD with FAO Statistical Cropland Area (a) and Other LULC/Cropland Products (b-f) (2000–2022). In (b–f), blue and red dots show the differences from FAO estimates*

for AFCD and other products, respectively. The purple line indicates the linear fit between AFCD and each product."

Q15. In Line 415, incorrect serial number.

A15: Thank you for pointing this out. We have corrected the serial number error in Line 415 to ensure consistency throughout the manuscript.