

Comments on essd-2026-613

This study presents CrRUC-M, an annual 10-m crop residue cover dataset for major global Mollisol regions during 2019–2024. By focusing on post-harvest surface conditions, the study provides information on agricultural management that is generally absent from conventional cropland and crop-type products. The development of a spatially continuous, field-scale dataset across multiple major agricultural regions represents a valuable effort, particularly given the transient nature of post-harvest residue conditions and the difficulty of obtaining temporally matched observations at large spatial scales. Overall, the manuscript is well organized, and the resulting dataset has the potential to provide a useful observational basis for studies of agricultural management and its environmental consequences. I have several comments regarding the interpretation, temporal consistency, validation, and uncertainty of the dataset.

Major comments

1. The temporal meaning of the annual crop residue cover maps needs to be more clearly defined. Crop residue cover can change rapidly after harvest because of tillage, residue removal, precipitation, or snow. CrRUC-M is generated from multi-temporal observations during the non-growing season rather than representing surface conditions on a specific date. Therefore, a residue-covered pixel may indicate that detectable residue occurred during a favorable observation period, rather than that residue persisted throughout the non-growing season. This distinction is important when interpreting the annual maps and their relationship with agricultural management. For example, a field with residues retained only briefly after harvest and another with residues retained throughout winter may both potentially be identified as residue cover. The authors should clearly define what an annual residue-cover label represents and distinguish residue occurrence from residue persistence when interpreting temporal changes.
2. The consistency of the binary residue-cover definition across regions and years should be further examined. The framework uses region-dependent spectral constraints followed by region- and year-specific Otsu thresholds. Consequently, the criterion defining “residue-covered” varies spatially and temporally. It is unclear whether pixels classified as residue-covered have a comparable physical meaning across the four regions and across 2019–2024. This is particularly relevant for the interannual analysis because changes in the MCRC SI distribution can also lead to changes in the Otsu threshold. Please report the thresholds for each region and year and examine their temporal variability. A comparison between the annual adaptive thresholds and a temporally fixed or pooled threshold would help determine whether the reported interannual patterns are sensitive to the changing classification criterion.
3. The uncertainty associated with the visually interpreted validation samples should be better evaluated. The combination of field surveys and temporally matched satellite-image

interpretation is understandable given the short-lived nature of crop residue cover. However, field observations are mainly available for Northeast China and the U.S. Midwest, whereas validation in other regions and years relies more heavily on visual interpretation of Sentinel-2 imagery. A substantial proportion of the reference data therefore originates from the same satellite observations used for mapping. Where possible, I suggest separately reporting accuracy based on directly field-observed samples and visually interpreted samples. The number and spatial/temporal distribution of the original field observations should also be reported more clearly. This would help assess how well the image-interpreted reference samples represent actual ground conditions.

4. Additional external comparisons could strengthen the evaluation of CrRUC-M. The comparisons with the Northeast China CRC dataset and USDA-NASS statistics are useful, but external evaluation remains limited for the other regions. The authors could consider comparison with the global cereal residue production and usage dataset of Smerald et al. (2023, *Scientific Data*, 10, 685). The two datasets describe different quantities, so this should not be considered direct validation. However, regional- or national-scale comparisons could help assess the consistency and differences between satellite-observed residue cover and statistics/model-based estimates of residue production and use, and better demonstrate the additional information provided by CrRUC-M.

5. Meteorological and observation-condition effects on mapping uncertainty should be assessed more quantitatively. The manuscript discusses cloud cover, precipitation, snow, and snowmelt as important limitations, but their effects are mainly addressed qualitatively. This deserves further analysis because the method relies strongly on SWIR information, which can be affected by moisture conditions, while persistent cloud or snow can substantially reduce the effective observation window. I suggest reporting the number of valid cloud- and snow-free Sentinel-2 observations during the non-growing season for different regions and years, and examining whether accuracy or omission errors vary with observation availability. If feasible, the effects of precipitation, soil moisture, or snow conditions could also be evaluated for representative regions or years.

Minor comments

1. The definition of the spatial domain could be more precise. The term “global Mollisol regions” may suggest a globally exhaustive soil-taxonomic delineation of Mollisols, whereas the study focuses on four major agricultural black-soil regions defined using administrative boundaries and multiple soil datasets. The authors should clarify the scope of the dataset and consider whether “major global Mollisol/black-soil regions” would more accurately describe the study domain.

2. The relationship between crop residue cover and conservation tillage could be described

more carefully in some parts of the manuscript. CrRUC-M maps a remotely sensed surface condition that is closely related to, but not necessarily equivalent to, a specific tillage practice. Similar residue-cover conditions may result from different management strategies. I suggest checking the relevant terminology and, where appropriate, clarifying that CrRUC-M provides observational information related to conservation agriculture rather than directly identifying specific tillage practices.

3. The Landsat analysis supports the potential for longer-term extension, but the interpretation of “transferability” could be more cautious. Although Landsat- and Sentinel-2-derived residue areas are strongly correlated at the aggregated scale, Landsat systematically produces lower estimates and lower classification accuracy. These systematic differences should be considered when discussing the feasibility of extending CrRUC-M to the pre-Sentinel-2 period.

4. The validation results show substantially higher omission than commission errors and an overall negative relative bias, indicating systematic underestimation of residue-covered areas. The implications of this bias should be discussed more explicitly, particularly for users interested in regional area statistics, temporal trends, or model parameterization.