Comment on essd-2025-215

This study developed the first nationwide 30 m resolution Soil and Water Conservation Terrace Measures Dataset (SWCTMD) of China from 2000 to 2020. Terrace is the most important type of soil conservation engineering measures for most areas in China, given the critical role of terraces in mitigating soil erosion, enhancing water retention, this work fills a critical data gap that has long constrained national-scale erosion modeling and conservation planning for decades. A two-stage classification framework was proposed, first distinguishing terraces from non-terraces and then classifying four terrace types: level terrace, slope terrace, zig terrace, and slope-separated terrace. The framework integrates time-series Landsat imagery, DEM data, and GlobeLand30 cropland data, employing the Random Forest classifier on the Google Earth Engine platform. Key findings include:

(1)Total terrace area increased from 400,896 km² in 2000 to 496,934 km² in 2020;

(2) Terraces were estimated to reduce about 818 million tons of soil erosion on croplands in 2020;

(3) The dataset outperforms previous products in spatial completeness and terrace type granularity at national scale;

(4) It supports applications in soil erosion modeling, ecosystem service assessment, and land management planning.

While the study is of high quality and makes a significant contribution, I would like to offer the following suggestions for improvement.

Suggestions and Minor Revisions Required :

(1)Some sentences in the manuscript require more precise wording and would benefit from a more rigorous formulation. For instance, Lines 74-75 currently states:

"Using this mapping framework, the first Soil and Water Conservation Terrace Measures Dataset of China (SWCTMD) was produced using time-series Landsat satellite imagery and digital elevation model data, covering the period from 2000 to 2020."

In fact, several nationwide terrace mapping efforts have been conducted prior to this study, such as the work by Cao et al. (2020), which generated a 30-meter resolution terrace map for China. While those studies were not based on long-term time series data, they do represent national-scale mapping efforts. Therefore, the sentence should be revised to clarify that the SWCTMD is the first long-term (two-decade) national terrace dataset, rather than the first national terrace dataset overall. Suggested revision: *"Using this mapping framework, we developed the first long-term (2000–2020) national Soil and Water Conservation Terrace Measures Dataset (SWCTMD) of China."*

Lines 370, *Reference: Cao B, Yu L, Naipal V, et al. A 30-meter terrace mapping in China using Landsat 8 imagery and digital elevation model based on the Google Earth Engine. Earth System Science Data Discussions, 2020: 1–35.*

Similarly, *Lines 108-109 "Compared to other DEM data, SRTM DEM is the most quality-controlled, broadest coverage, and highest accuracy DEM among open-source data"*

While SRTM has historically been one of the most widely used and quality-controlled global DEM datasets, it is worth noting that in recent years, several newer open-access DEM products, such as ALOS AW3D30 and Copernicus DEM, have demonstrated higher spatial resolution and improved accuracy in many regions, including mountainous and vegetated areas.

(2)According to the manuscript, all four types of terraces used in the study are assigned dimensionless

conservation factor (P or E-values) below 0.343. This implies that, under the RUSLE/CSLE framework, terrace implementation on a given slope would reduce potential soil loss by at least 65.7%. Furthermore, since terraces are predominantly distributed on sloping croplands, areas generally subject to higher erosion rates, the expected relative reduction in soil loss should arguably be even more significant when terraces are applied. However, In Section 3.4, the authors state that, ″In comparison to the scenario without terrace measures, the amount of soil erosion in the regions of Yunnan, Sichuan, Chongqing, Guizhou, Gansu, Shanxi, and Shaanxi regions decreased by 47.47%, 46.02%, 45.57%, 45.25%, 35.48%, 29.75%, and 27.80%, respectively (Fig. 8b)″. Therefore, I would appreciate it if the authors could clarify the reason behind.

(3)While the overall accuracy (OA) and Kappa coefficient reported for the classification results appear high, this does not necessarily imply satisfactory classification performance. Notably, the Producer's Accuracy (PA) for *zig terraces* and *level terraces* was particularly low (as low as 15–25%), and their corresponding F1-scores were generally below 40%, indicating considerable misclassification and omission errors. Such results suggest that these terrace types may have been substantially underestimated in the dataset. It is important to note that high OA/Kappa values may be misleading in imbalanced classification tasks, especially when majority classes dominate the confusion matrix. The low performance metrics for certain terrace types likely reflect a combination of factors, including:

Class imbalance between dominant and minority categories during model training;
Limited or unrepresentative training samples for fragmented or narrow terraces;
Intrinsic heterogeneity in real-world spatial distribution, especially in mountainous regions;
Fragmented and narrow terraces are especially prone to omission;
Spectral confusion and mixed pixels in medium-resolution imagery.

These aspects should be discussed in the manuscript to provide a more nuanced interpretation of the classification results and to guide future refinement. The authors may also refer to relevant studies for in-depth discussions on these issues.

(4) Since the manuscript involves the quantitative assessment of soil and water conservation benefits of terraces, particularly through the estimation of soil erosion reduction, it is important to critically examine the assumption of using a uniform conservation factor (P-value or E-value) for the same type of terrace measures across different regions of China. While assigning a single value to each terrace type simplifies the model and facilitates national-scale analysis, it may overlook important spatial heterogeneity in terrace structure, maintenance conditions, climatic regimes, and land management practices. For example:

The same "slope terrace" may perform differently in terms of erosion control in Yunnan's highlands compared to the Loess Plateau, due to differences in rainfall erosivity, soil properties, and vegetation cover; Engineering design standards and actual field implementation of terraces may vary significantly between provinces, leading to divergence in functional effectiveness; The topographic context (e.g., slope gradient, curvature) strongly influences the conservation outcome, even for structurally similar terraces.

Therefore, I recommend that the authors acknowledge and briefly discuss the limitations of using fixed terrace factor values in erosion modeling across diverse environmental settings.