# Responses to Reviewers Comments

## Reviewer #6

I think this manuscript has been revised in accordance with the review comments and is ready for publication.

**Thank you very much for the valuable feedback and suggestions.**

## Reviewer #7

I am glad to read the ms of RS-based vegetation mapping in Tibetan Plateau, where the regional in-situ observation is impossible. Generally, I thought this ms an interesting work and the useful result derived. I read through the answers from authors to previous reviewing comments, and also though several issues to be re-considered before publication.

***Q1:*** Method of this dataset was based on detecting actual changes in vegetation covers between two neighbouring years. However, the total change in vegetation types at 500-m scale between two years is not highly possible. Although the samples with high pixel purity were chosen in RF training, the authors should make sure of the pixels with potential changes in vegetation covers meeting the purity requirement (so that the pre-trained RF model could be used).

***Answer:*** Thank you for your suggestion. As you pointed out, the likelihood of significant changes in vegetation types between two years at a 500 m resolution is relatively low. However, our approach ensures that both the selected training samples and the pixels with potential vegetation changes meet purity criteria. Mixed pixels are common in remote sensing applications, especially at lower resolutions. According to remote sensing theory, the dominant type of a pixel (i.e., the type with the largest proportion) typically represents the pixel’s overall attribute. Therefore, when selecting training samples, we choose high-purity pixels to ensure that these samples reflect the vegetation type they represent. It is worth noting that changes in the minor components of a pixel typically do not have a significant impact on the pixel's overall attribute and are challenging to detect as potential changes at 500 m resolution. Consequently, our change detection algorithm focuses on identifying significant changes in the dominant type, ensuring that the detected change areas maintain high purity and meet the analytical requirements of the study.

***Q2:*** The RF model was trained in 2020, and the result of 2020 was then used to update the maps of rest years gradually. The errors in 2020 would propagate to other year. Did authors compare the maps of rest years directly predicted using 2020-trained RF model with the maps of current gradually updating method?

***Answer:*** Thank you for your comments. Due to the temporal and spatial distribution differences of remote sensing imagery and the inherent randomness of machine learning classifiers, directly using the model trained on 2020 data to predict maps for other years may result in discontinuities and unreasonable changes (Liu et al., 2021; Du et al., 2023). We initially attempted to use the 2020 model to directly predict maps of other years on the QTP, but the results showed significant error accumulation. To address this issue, we adopted the gradually updating method, which has been demonstrated to be effective in previous studies. For example, Zhang et al. (2024) used a CCDbased gradually updating method to generate GLC-FCS30D products with higher temporal and spatial consistency.

***Q3:*** Over past 20+ years, there were possible radiative drifts in the MODIS equipment, and could those influence identifying gradual transmission between vegetation types?

***Answer:*** Thank you for your suggestion. Over the past two decades, MODIS sensors have indeed experienced some degree of radiometric drift. However, the MODIS Calibration Team has significantly mitigated this issue in the Collection 6 (C6) products by implementing recalibrations involving the solar diffuser, lunar measurements, and scan angle corrections (Doelling et al., 2015). Studies have demonstrated that the radiometric stability of C6 products is maintained within 1% (Doelling et al., 2015). The MOD09A1 product utilized in this study is derived from the C6 collection, effectively minimizing the influence of radiometric drift on data quality. Furthermore, vegetation type classification in this study is not solely dependent on spectral information; it also integrates meteorological and topographic factors. As a result, the potential impact of radiometric drift on identifying gradual transitions between vegetation types is negligible.

**References**

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Du, Z., Yu, L., Li, X., Zhao, J., Chen, X., Xu, Y., Yang, P., Yang, J., Peng, D., Xue, Y., and Gong, P.: Integrating remote sensing temporal trajectory and survey statistics to update land use/land cover maps, Int. J. Digit. Earth, 16, 4428-4445, https://doi.org/10.1080/17538947.2023.2274422, 2023.

Liu, L., Zhang, X., Gao, Y., Chen, X., Shuai, X., and Mi, J.: FinerResolution Mapping of Global Land Cover: Recent Developments, Consistency Analysis, and Prospects, J. Remote Sens., 2021, 5289697, https://doi.org/10.34133/2021/5289697, 2021.

Zhang, X., Zhao, T., Xu, H., Liu, W., Wang, J., Chen, X., and Liu, L.: GLC_FCS30D: the first global 30 m land-cover dynamics monitoring product with a fine classification system for the period from 1985 to 2022 generated using dense-time-series Landsat imagery and the continuous change-detection method, Earth Syst. Sci. Data, 16, 1353–1381, https://doi.org/10.5194/essd-16-1353-2024, 2024.

## Thanks to the reviewer for these valuable feedback and valuable suggestions.

## Reviewer #8

The authors have generated a 500-meter resolution vegetation distribution product for the Qinghai-Tibet Plateau from 2000 to 2022. The dataset was based on a previously created 10-meter resolution Vegetation map of the Qinghai-Tibet Plateau (2020), a series of spectral indices calculated from MOD09A1 products, and continuous change detection methods. The topic is interesting, and the product provides a new data source for the Qinghai-Tibet Plateau. However, I have some concerns about the expression and the innovation of the methods used in the paper:

***Q1:*** I understand that the main significance of the paper is producing a new product rather than developing a new method. Currently, the authors emphasize the innovation of their methods too much, but the various methods used are not newly proposed in this paper; they have just not been applied to the Qinghai-Tibet Plateau before. I suggest that the authors focus more on data innovation and downplay the method innovation.

***Answer:*** Thank you for your suggestion. The core significance of this study lies in the innovation of the data product, rather than the innovation of the methodology. Based on your suggestion, we have simplified the description of the methods section to further highlight the uniqueness and scientific value of the data product. Please see lines 232-303 in revised manuscript.

***Q2:*** The authors selected some pure pixels from the 10-meter resolution vegetation map as training data for the 500-meter resolution mapping. I have some questions about this. Although 10-meter resolution data have higher spatial resolution, this does not necessarily mean higher accuracy. In fact, the spatial and temporal consistency of high-resolution satellite reflectance is not as good as that of moderate-resolution satellites like MODIS, leading to more uncertainties. When creating the 10-meter vegetation map, the authors should have used local field sampling data. Why not use this data as training data?

***Answer:*** Thank you for your suggestion. To produce the 10 m resolution vegetation map of the Qinghai-Tibet Plateau (QTP), we utilized a limited but highly reliable set of field survey samples. To address the limited availability of high-quality samples, additional training samples were generated through visual interpretation in areas near existing samples, enabling the creation of the 10 m vegetation map. However, most field samples were collected in easily accessible areas such as roads and towns, where mixed pixel effects at the 500 m scale were significant, reducing the representativeness of these samples. Furthermore, only a small portion of field samples collected for validation through literature review passed the 500 m scale homogeneity filtering process. As a result, the field samples were not only limited in number but also exhibited low reliability at the 500 m scale, making them unsuitable as training data for this study. Given these limitations, we did not use field samples as training data for vegetation mapping. Instead, we automatically generated highly representative samples in high-purity areas based on the existing 10 m vegetation map, allowing for the successful production of the 500 m resolution vegetation map of the QTP.

***Q3:*** The authors used continuous temporal information to improve the mapping stability and introduced continuous change detection methods, which is very interesting. However, the description of the mapping methods and processes needs improvement. Figure 2 is an important figure showing the mapping process, but it is not intuitive enough. The figure labels subfigure numbers but lacks explanations. Moreover, the figure is difficult for readers to understand. I suggest improving it. Generally, figures should be self-explanatory and understandable without relying heavily on the text.

***Answer:*** Thank you for your suggestion. We appreciate your recognition of the innovative aspects of our method, particularly the use of continuous temporal information and change detection to enhance mapping stability. Regarding Figure 2, we acknowledge that the original version may not have been sufficiently intuitive or self-explanatory. To address this, we have restructured the figure to present the mapping process in a more logical and visually engaging manner, reducing reliance on accompanying text. Please see lines 233-242 in the revised manuscript.

***Q4:*** In Line 311, the text mentions "NDGlaI 15%, NDGlaI 90%, IBI 30%, NDBI 90%, IBI 15%, IBI 90%, EVI 90%, NDVI 90%, IBI 75%, IBI 60%, LSWI 90%, M 90%, and IBI 45%". What do these terms mean?

***Answer:*** Thank you for your question. The terms mentioned in the text, such as "NDGlaI 15%" and "NDVI 90%", refer to the corresponding percentile values of the respective indices. For example, "NDGlaI 15%" indicates the value of NDGlaI at the 15th percentile of the sample data, while "NDVI 90%" refers the value of NDVI at the 90th percentile. Using these percentile values helps to better capture the distribution characteristics of each index, highlighting local value features of the variables, thereby improving classification accuracy in subsequent models.

***Q5:*** The abbreviations in the text need to be standardized. Many abbreviations are uncommon or unnecessary. For example, LCSV is not a common abbreviation and is unnecessary, and its full forms are inconsistent in the text. Abbreviations like ECF are not necessary and are hard to understand. The full forms of methods like RF are missing. I suggest reviewing all abbreviations in the text and removing unnecessary ones.

***Answer:*** Thank you for your suggestion. We have carefully reviewed all abbreviations in the text and adjusted those that are less commonly used or unnecessary. For instance, in the revised manuscript, we have added the full form of "RF" as "random forest" in lines 193-194 and updated

"LCSV" to its full form, "land cover and surface vegetation," in lines 12, 29, and 41. However, abbreviations such as "EBF" and "ECF" were retained to represent the 16 vegetation types on the QTP. While these abbreviations may not be universally familiar, their full forms are lengthy and occur frequently throughout the text and figures. To enhance the manuscript's readability, we decide to retain these abbreviations while providing their full forms and explanations upon their first mention. Furthermore, the use of 'EBF' for 'Evergreen Broadleaved Forest' aligns with the naming conventions frequently adopted in related studies (Zhang et al., 2024).

**References**

Zhang, X., Zhao, T., Xu, H., Liu, W., Wang, J., Chen, X., and Liu, L.: GLC_FCS30D: the first global 30 m land-cover dynamics monitoring product with a fine classification system for the period from 1985 to 2022 generated using dense-time-series Landsat imagery and the continuous change-detection method, Earth Syst. Sci. Data, 16, 1353–1381, https://doi.org/10.5194/essd-16-1353-2024, 2024.

**Thank the reviewer very much for these constructive comments and suggestions.**