Responses to dear Nima Zafarmomen

This study presents a robust and scientifically significant contribution to the field of hydro-climatology and precision agriculture. The novelty of this work lies in its integrated methodological framework that successfully bridges the gap between coarse-resolution satellite observations and the high-resolution requirements of regional drought assessment. While the manuscript is well-structured, the following minor points should be addressed to enhance clarity and depth:

Reply: Thank you sincerely for your positive appraisal of our work and your highly constructive minor comments—your insights have offered invaluable guidance to enhance the manuscript's clarity, quantitative rigor, and theoretical depth. We deeply appreciate the time, expertise, and meticulous attention to detail you dedicated to reviewing our study, and we have carefully deliberated on each of your points. Below is our preliminary response outlining how we will address your suggestions through substantive revisions to the manuscript:

Minor Comments for Improvement

1. The term "file-scale" appears to be a typo. It should likely be corrected to "field-scale" to accurately reflect the context of agricultural monitoring.

Reply: Thank you sincerely for your valuable comment. This is indeed a typo and will be corrected to "field-scale" in the revised manuscript.

2. In the comparison between original and downscaled images, the "zoomed-in" areas are very helpful. However, it would be beneficial to explicitly state the specific geographic location (e.g., coordinates or province) of the zoomed-in sub-regions in the figure caption to provide better context.

Reply: Thank you for your helpful suggestion. We agree that specifying the geographic location will enhance context. We plan to supplement the latitude and longitude information of the zoomed-in sub-regions in the figure caption. Attached is the preliminary revised figure (Fig.1), and we will further refine its presentation for better aesthetics in the revised manuscript.

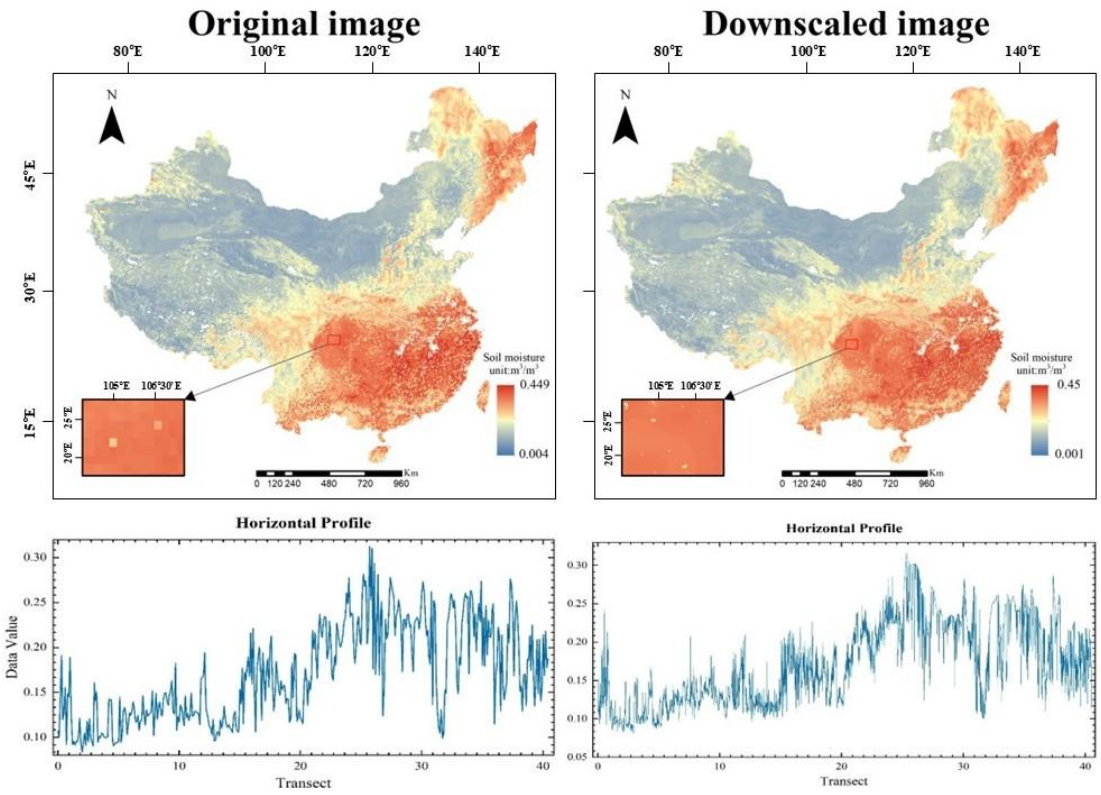

Fig.1 Comparison of original images and downscaled SM images (Preliminary Revision)

3. You mention that TVDI and precipitation were dominant predictors. It would be valuable to include a small Feature Importance Plot (perhaps as a sub-panel in Figure 2 or 3) to quantitatively show the contribution of each environmental covariate.

Reply: Thank you for your excellent suggestion. We will follow your guidance and add a Feature Importance Plot (as a sub-panel in Figure 2) to quantitatively illustrate the contribution of each environmental covariate in the revised manuscript.

4. In Section 5, you mention that the study is constrained by "static SSI thresholds." Briefly expanding on how dynamic thresholds (accounting for different crop phenological stages) might change the results in the future would strengthen the "Future Work" portion of the discussion.

Reply: Thank you for your insightful guidance on this point. We are currently conducting related research on agricultural drought identification using dynamic SSI thresholds, specifically targeting the Yellow River Basin. This work incorporates both different crop phenological stages and key contextual factors (e.g., crop type distribution and soil texture heterogeneity), and preliminary results indicate a notable improvement in drought identification accuracy compared to the static threshold approach. We will expand the “Future Work” section in the discussion to elaborate on how the application of such dynamic thresholds may refine the results and enhance the adaptability of our framework for diverse cropping systems in future studies.

5. Finally, while the study correctly identifies groundwater depletion and irrigation expansion as compounding drivers of drought in the YRB-HRB regions (Line 475), the discussion would be significantly strengthened by acknowledging the role of high-resolution vegetation data in modeling these interactions. I strongly recommend considering and discussing the implications of studies such as "Assimilation of sentinel‐based leaf area index for modeling surface‐ground water interactions in irrigation districts". Integrating such perspectives would provide a deeper theoretical link between satellite-derived vegetation indices (like the LAI used in your RF model) and the complex subterranean water dynamics that govern agricultural moisture availability in China's intensive irrigation zones.

Reply: Thank you sincerely for your insightful and valuable guidance—your comment not only helps strengthen the theoretical depth of our current manuscript but also provides crucial inspiration for our ongoing research, and we are truly grateful for this dual contribution.

For the current manuscript, we fully agree that acknowledging the role of high-resolution vegetation data in modeling groundwater depletion-irrigation expansion-drought interactions will significantly enhance the discussion. We will cite this study and strengthen the discussion by explicitly acknowledging the role of high-resolution vegetation data in modeling these interactions.

Regarding our ongoing research, your guidance has been highly illuminating. We will further explore the gain effect of high spatiotemporal resolution data (including high-resolution vegetation data) on the accuracy of agricultural drought identification. Specifically, we will design comparative experiments to quantify how integrating high spatiotemporal resolution vegetation, soil moisture, and groundwater data improves the precision of drought onset timing, intensity classification, and spatial extent mapping—compared to conventional low-resolution data. We aim to clarify the optimal combination of high-resolution data sources for different agricultural zones, which will help refine our drought identification framework and enhance its applicability in intensive irrigation areas.

We are actively revising the manuscript in line with your valuable suggestions. Due to current system constraints, we are unable to upload the revised manuscript at this stage—per the journal's process, we can only submit the updated version once the official notification for manuscript revision is received. Rest assured, we will complete all required revisions comprehensively and submit the polished manuscript promptly upon receiving the upload instruction. Once the revised manuscript is submitted, we will immediately respond to your comment to inform you of the submission, and we sincerely welcome your further comments and guidance. Thank you again for your invaluable advice and continued attention to our work.