Answer to Reviewers' Comments

We thank the editor for the overall guidance. We also thank the reviewers for taking the time to review our manuscript and offer constructive comments and wisdom for improvement. We have considered all the comments and addressed the questions raised by the reviewers to improve our work presented in the paper. In the following text, the reviewer's questions/comments are listed in black font and the response by the authors in blue font. All line number references mentioned in this response to reviewers refer to the revised version of our manuscript.

As part of the revision process, we have substantially revised the manuscript. Detailed, point-by-point responses to each reviewer are provided below, with a brief summary of the major revisions included at the beginning of each reviewer's section.

Reviewer #2

The authors have developed a satellite remote sensing-based method of estimating irrigation requirements at the field application scale – utilizing the Penman-Monteith and the SEBAL methods of evapotranspiration – and the sDRIPS approach to provide irrigation advisory for surface water resources allocation.

The manuscript is very well-written, with a thorough literature review, visualizations, and rationale of the applications approach. The mathematical equations and details of the step-by-step approach for irrigation requirements calculation is appreciated. The results with figures and the detailed discussion on the limitations are noted as well.

We sincerely thank Reviewer #2 for the thorough and constructive review of our manuscript, as well as for the positive assessment of the clarity, methodological rigor, visualizations, and discussion of limitations in the manuscript. Overall, reviewers' comments were on

1) clarification on figures,
2) the source of the data,
3) the most appropriate units for representing irrigation information

We have addressed these points in the revised manuscript, and detailed, point-by-point responses to each comment are provided below.

1. Lines 84-86: For the 'How much' of irrigation – isn't the unit depth of irrigation (L) a better estimate for irrigation requirements (also widely used metric across the world)? From the water depth required, the water volume (L^3) and the flow rate (L^3/T) can easily be calculated based on field size and hydraulic infrastructure?

We partially agree with the reviewer's comment. We concur that irrigation depth is a widely used and intuitive metric for expressing irrigation requirements, particularly at the field and farm-management scales. The proposed framework fundamentally estimates irrigation requirements in terms of an equivalent water depth, consistent with established agronomic practice. This depth based estimate is subsequently converted to volumetric units (L^3) based on the irrigated area.

The emphasis on volumetric units in the manuscript is intentional and reflects the intended operational context of the framework. Specifically, volumetric representations are more suitable for surface water allocation and system-level decision-making, such as at the canal-command scale, where water delivery is typically managed in terms of total volume to be supplied. Furthermore, the in-situ water supply data used for comparison were provided by stakeholders in volumetric units rather than depth.

The choice of metric is therefore user-dependent. For farmers, field-level advisories expressed as irrigation depth are directly actionable. In contrast, canal operators and water managers are responsible for allocating water across multiple fields within a canal command area (including downstream and secondary canals) and therefore require estimates of aggregate water volume rather than depth. Importantly, depth, volume, and flow-rate metrics are readily interconvertible based on field area and locally available hydraulic characteristics.

2. Lines 360, 366: In Equations 5 and 6, how is 'Field Capacity' estimated? It is unclear.

   Field capacity is not directly estimated within the sDRIPS framework. Instead, sDRIPS relies on externally derived soil hydraulic properties obtained from global soil datasets.

   In the revised manuscript, we clarify that field capacity is obtained from the ISRIC SoilGrids dataset (https://isric.org/explore/soilgrids, Poggio et al., 2021) as the volumetric soil water content at a matric potential of ~ -33 kPa, which is widely accepted as a proxy for field capacity (Hengl et al., 2017; Poggio et al., 2021).

   To improve clarity, we have updated Table 1 in the Data section (of the revised manuscript) to explicitly document this data source.

3. The visualizations of Figure 2 are excellent. The gridded 'Surplus/Balanced/Deficit Regions' approach are not, however, found later. Is Figure 4 a modified version of this approach? Are the gridded calculations aggregated at the field scale in later figures?

   We thank the reviewer for the positive feedback on Figure 2 and for the insightful question regarding the relationship between the conceptual figure and the subsequent figures.

Figure 2 is intended to present the conceptual and computational foundation of sDRIPS for any general region, illustrating how evapotranspiration-based water balance components are first computed at the pixel (grid) scale. At this stage, each pixel is classified as surplus, balanced, or deficit based on evapotranspiration and precipitation water balance.

Figure 4 does not represent a separate or modified approach. Rather, it provides a spatially explicit example of the same grid-based framework illustrated in Figure 2, applied to a specific command area within the Teesta Barrage Project (TBP) for a particular date.

In subsequent figures, the reviewer is correct that these grid-level calculations are aggregated to higher spatial scales. Specifically, pixel-level surplus and deficit estimates are first aggregated to the field scale and then at the command-area scale to support operational water allocation decisions. Overall, Figure 2 presents the general grid-based conceptual framework, Figure 4 demonstrates its application for a specific region and date, and the subsequent figures illustrate the aggregation of this grid-based information to management-relevant scales.

References for Reviewer 2:

Hengl, T., Jesus, J. M. de, Heuvelink, G. B. M., Gonzalez, M. R., Kilibarda, M., Blagotić, A., Shangguan, W., Wright, M. N., Geng, X., Bauer-Marschallinger, B., Guevara, M. A., Vargas, R., MacMillan, R. A., Batjes, N. H., Leenaars, J. G. B., Ribeiro, E., Wheeler, I., Mantel, S., & Kempen, B. (2017). SoilGrids250m: Global gridded soil information based on machine learning. *PLOS ONE*, *12*(2), e0169748. https://doi.org/10.1371/journal.pone.0169748

Poggio, L., de Sousa, L. M., Batjes, N. H., Heuvelink, G. B. M., Kempen, B., Ribeiro, E., & Rossiter, D. (2021). SoilGrids 2.0: Producing soil information for the globe with quantified spatial uncertainty. *SOIL*, *7*(1), 217–240. https://doi.org/10.5194/soil-7-217-2021