Manuscript Number: EGUSPHERE-2026-3119

Manuscript Title: Understanding ecosystem gross primary productivity, evapotranspiration, and water use efficiency of maize using ISBA-A-g_s land surface model over temperate and tropical semi-arid climates.

AUTHORS' RESPONSES TO REFEREE-1 COMMENTS

The manuscript titled "Understanding ecosystem gross primary productivity, evapotranspiration, and water use efficiency of maize using ISBA-A-gs land surface model over temperate and tropical semi-arid climates" evaluates the performance of the ISBA-A-gs model in simulating key ecohydrological fluxes (, , and) across two distinct climate regimes (temperate France and tropical semi-arid India). The authors successfully calibrated site-specific parameters to capture carbon-water dynamics under different irrigation practices. While the application of a process-based model to cross-climatic regimes is interesting and relevant, the manuscript is excessively lengthy and dense, which occasionally makes it difficult to understand the core findings. Streamlining the text and restructuring the presentation of results will significantly improve readability and impact.

- We sincerely thank the reviewer for the positive feedback and for recognizing the significance of applying the process-based ISBA-A-g_s land surface model to investigate ecosystem carbon-water dynamics under contrasting climatic conditions and irrigation practices. In response to the reviewer's suggestions, we have thoroughly revised the manuscript to improve its clarity, conciseness, organization, and overall readability.

Specifically, we propose the following revisions:

- Introduction: In the revised version, the introduction was condensed by removing the redundant texts, with logical orientation and distilled scientific review on the significance and need for understanding ecosystem gross primary productivity, evapotranspiration, and water use efficiency. The newly written introduction is expected to enhance the overall logical flow of the text.
- Results: In the revised version, we logically reorganize the results section to improve clarity and better align with the objectives of the study.

The revised structure is as follows:

1. Section 3.1 - Dynamics of GPP, ET, and WUE characterizes the observed seasonal dynamics of GPP, ET, and WUE under the contrasting hydro-climatic conditions, thereby addressing objective (i).
2. Section 3.2 - Model Calibration describes the optimized site-specific parameters, evaluates their role in simulating carbon and water fluxes, and discusses their implications, thereby directly addressing objective (ii).
3. Section 3.3 - Model Performance evaluates the ability of the calibrated ISBA-A-g_s model to reproduce the seasonal and cumulative dynamics of GPP, ET, and WUE under contrasting hydro-climatic conditions and irrigation treatments using statistical performance metrics, thereby directly addressing objective (iii).
4. Section 3.4 - Diagnostic Analysis assesses the model's capability to reproduce the underlying eco-physiological mechanisms governing carbon-water interactions using the uWUE and EF-VPD relationships, thereby directly addressing objective (iv).

- Section 3.1 (Sites meteorology and vegetation characteristics) of the previous version is integrated with Section 2.1 (Experimental sites description) to avoid repetition.
- Discussion: In the revised version, the discussion section is reorganized into three focused paragraphs that address (i) model calibration, (ii) model performance under contrasting hydro-climatic conditions, and (iii) the eco-physiological insights obtained from the diagnostic analyses.

The Introduction provides an excellent, comprehensive background on , maize agro-ecosystems, and the history of the ISBA model framework. However, it is excessively long, making it difficult to understand the overarching research gap until lines 196–201. I recommend streamlining the introduction to establish a more direct line of sight to the study's novel contributions. Furthermore, the alignment between the stated objectives and the results should be tightened. Specifically, it is not immediately clear how objectives (iii) and (iv) are systematically isolated and resolved in the text. Please restructure the Results and Discussion sections to explicitly map back to these objectives.

- We sincerely thank the reviewer for the positive comments on the introduction. Following reviewer suggestion, we have substantially revised and streamlined the introduction to provide a clearer progression from the general background to the research gap, novelty,

and study objectives. In the revised manuscript, we plan to organize the introduction more sequentially as follows:

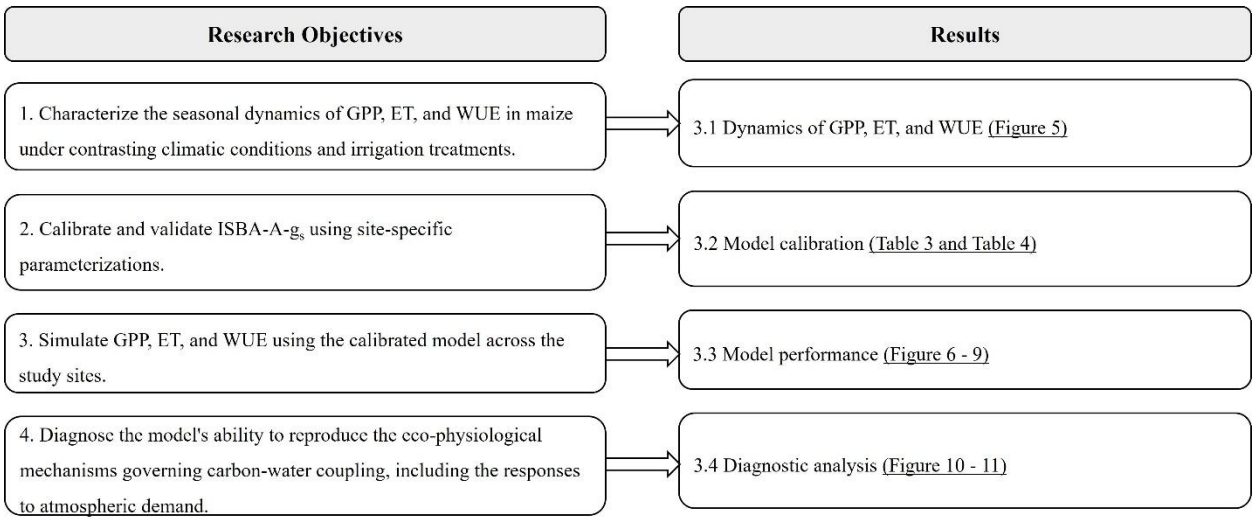
1. The first paragraph introduces the significance of water-carbon coupling and ecosystem water use efficiency (WUE). It highlights the importance of simulating water-carbon coupling through land surface models (LSMs).
2. The second paragraph is followed by the ISBA-A-g_s land surface model, summarizes recent developments in its Multi-Energy Balance (MEB) configuration, and highlights its limited application for simulating coupled carbon-water dynamics under tropical semi-arid and temperate climates and contrasting irrigation practices.
3. The third paragraph discusses the importance of maize as a globally significant crop, emphasizes the contrasting hydro-climatic characteristics of temperate and tropical semi-arid agro-ecosystems, and explains the need to evaluate land surface models across these contrasting environments.
4. The fourth and fifth paragraphs focuses on irrigation management, contrasting irrigation practices in France and India, and introduces the eco-physiological basis of carbon-water coupling together with the importance of diagnostic metrics for evaluating model performance.
5. The sixth paragraph describes the existing research gap at the outset, highlights the novelty of the present study, and states the research objectives of the present work.

- Overall, these revisions substantially reduce redundancy, improve the logical flow of the introduction, and establish a clearer and more direct connection between the background, the identified research gap, and the novel contributions of the present study.
- Regarding the connection between the research objectives and the corresponding results and discussion, we reorganized the results and discussion sections to directly align with the four research objectives presented in the introduction.

For example:

- Section 3.1 describes the dynamics of gross primary productivity, evapotranspiration, and water use efficiency (characterizing the observed seasonal dynamics of GPP, ET, and WUE under the contrasting hydro-climatic conditions, thereby addressing objective (i)).

- Section 3.2 discusses model calibration describing the optimized site-specific parameters, evaluating their role in simulating carbon and water fluxes. It further discussed their implications, thereby directly addressing objective (ii).
- Section 3.3 shows the model performance evaluating the ability of the calibrated ISBA-A-g_s model to reproduce the seasonal and cumulative dynamics of GPP, ET, and WUE under contrasting hydro-climatic conditions and irrigation treatments using statistical performance metrics, thereby directly addressing objective (iii).
- Section 3.4 presented the diagnostic analysis assessing the model's capability to reproduce the underlying eco-physiological mechanisms governing carbon-water interactions using the uWUE and EF-VPD relationships, thereby directly addressing objective (iv).
- The results section has been reorganized into four subsections aligned with the study objectives as shown in below flowchart.



An illustrative diagram showing the sequence of results corresponding to the research objectives and the respective figure numbers associated with the description of results falling under individual research objectives.

- Similarly, the discussion section was reorganized to interpret the major findings corresponding to (i) model calibration, (ii) model performance across contrasting hydro-climatic conditions and irrigation treatments, and (iii) the diagnostic analyses of ecosystem carbon-water interactions.

- This revised organization thus establishes a clear and systematic correspondence between the study objectives, the results, and their interpretation, thereby improving the overall logical flow and readability of the manuscript.

The Results section reads more like an extended narrative and contains text that belongs elsewhere. For example: Section 3.1 (Site Meteorology and Vegetation): This section describes the environmental forcing data rather than new experimental or model findings. To tighten the manuscript, this text should be significantly condensed and integrated into Section 2.1 (Experimental sites description) within the Materials and Methods section.

- We agree with the reviewer, we revised the manuscript by integrating the original section 3.1 (sites meteorology and vegetation characteristics) into section 2.1 (Experimental sites description). This restructuring eliminates redundancy by presenting the environmental and vegetation characteristics together with the site description, allowing readers to understand the study conditions before the model simulations are introduced.

Section 3.3 (Model Calibration): This section is redundant as it essentially reiterates the exact numerical values already clearly presented in Table 5 and Table 6. The text should be condensed to focus strictly on the biophysical interpretation of why these parameters shifted between the sites and irrigation treatments, rather than repeating the data tables.

- Agreed. In the revised version, we condensed section 3.3 (model calibration) by removing redundant descriptions of the calibrated parameter values presented in Table 5 and Table 6. The revised section emphasizes the biophysical interpretation of the optimized site-specific parameters, their influence on carbon and water flux simulations, and their implications for model behaviour and ecosystem functioning, thereby providing a more concise and scientifically focused discussion.
- Furthermore, we have now expanded the discussion to interpret the differences in calibrated parameter values between the FR-Lam and Ind-IITH sites in terms of their underlying eco-physiological significance as shown in below:

"The calibrated ISBA-A-g_s framework demonstrated robust performance in reproducing the magnitude and seasonal dynamics of GPP, ET, and WUE across the temperate FR-Lam and semi-arid Ind-IITH sites, demonstrating its ability to represent coupled carbon-water processes under

contrasting hydro-climatic conditions. The calibrated parameter sets further revealed distinct ecosystem functioning between the two sites. Higher values of GC and D_{Max} at FR-Lam (Table 3) indicate stronger regulation by atmospheric demand, whereas higher values of gm and F2I at Ind-IITH (Table 4) reflect greater sensitivity to irrigation management and soil moisture availability. These contrasting parameter responses are consistent with the differing climatic regimes and water management practices at the two sites, highlighting the ability of ISBA-A-g_s to realistically represent site-specific ecohydrological processes governing ecosystem carbon assimilation and water use."

"This is now included in the revised manuscript (Lines: 664 to 667)."

Line 444: The description of the optimization algorithm requires more technical clarity. The authors state that a "one-at-a-time" sensitivity analysis was performed followed by 50 simulations per parameter. It is unclear if the final parameter selection was achieved via automated iterative optimization or manual tuning. Please explicitly state the exact mathematical or algorithmic approach used to isolate the final "optimal values" to ensure reproducibility.

- We agree that the original manuscript did not clearly provide sufficient detail regarding the calibration procedure. In response, we have substantially revised the model calibration section to explicitly describe the complete calibration workflow and improve its reproducibility. We included this in the revised version of the manuscript.

Specifically, we now clarified that:

- A one-at-a-time (OAT) sensitivity analysis was first performed by independently varying each parameter within its physically realistic range while keeping all remaining parameters fixed.
- For each parameter, 50 model simulations were conducted using the calibration datasets.
- Parameter sensitivity was evaluated using a Pareto-based multi-objective framework, with root mean square error (RMSE) and coefficient of determination (R^2) as the objective functions, together with the Kolmogorov-Smirnov (KS) test to identify the most influential parameters.
- No automated optimization algorithm was employed. Instead, the sensitive parameters were manually refined through an iterative trial-and-error procedure, whereby parameter

values were progressively adjusted within their physically realistic ranges and the resulting simulations were repeatedly evaluated using RMSE and R^2 until further improvements became negligible while maintaining physically realistic parameter values.

- We also clarified the calibration and validation strategy adopted for the FR-Lam and Ind-IITH sites, including the rationale for the absence of independent temporal validation at the Ind-IITH site. These revisions explicitly describe the workflow used to determine the final optimized parameter values and substantially improve the transparency and reproducibility of the calibration methodology.

Figures 6 and 8: In the scatter plots comparing daily observations against simulations, the authors have plotted a best-fit regression line. While a 1:1 line allows the reader to visually assess under- or over-estimation (bias) immediately. I highly recommend modifying these figures to display a 1:1 line.

- Agreed, we have revised Figures 6 and 8 by replacing the best-fit regression line with a 1:1 reference line. We included this in the revised manuscript.

Line 199: Please explain what is meant by "climate-specific parameterization".

- The term "climate-specific parameterization" was intended to describe parameter sets calibrated separately for the two contrasting climatic environments (temperate FR-Lam and tropical semi-arid Ind-IITH). However, we agree that this terminology is too broad and may be misleading, as the parameterization was performed individually for each study site rather than for climate types in general.
- To improve clarity, we have now revised the second study objective by replacing "climate-specific parameterization" with "site-specific parameterizations", which more accurately reflects the methodology adopted in this study.
- The revised objective now reads as:

"Calibrate and validate ISBA-A-g_s using site-specific parameterizations"

"This is now included in the revised manuscript (Line: 158 to 159)."

Minor correction: Please correct the narrative citation style. When the authors' names are part of the sentence structure, only the year should be in parentheses (e.g., change "developed by (Noilhan and Planton, 1989)" to "developed by Noilhan and Planton (1989)"). This occurs in several places in the text (e.g., Calvet et al., 1998; Boone et al., 2017).

- Agreed, all narrative citations have been revised throughout the manuscript and included in the revised submission.

AUTHORS' RESPONSES TO REFEREE-2 COMMENTS

This manuscript evaluates the performance of the ISBA-A-gs land surface model in simulating gross primary productivity (GPP), evapotranspiration (ET), and water use efficiency (WUE) of maize across two contrasting agroecosystems: a temperate site in France and a tropical semi-arid site in India. The study is based on a rich observational dataset, including eddy covariance measurements, meteorological observations, vegetation variables, and irrigation information. The modelling results are generally encouraging, particularly for GPP, and the comparison between conventional and alternate furrow irrigation is potentially useful for understanding carbon-water trade-offs in irrigated maize systems.

- We sincerely thank the reviewer for the positive feedback on our manuscript and for recognizing the significance of this study. We are pleased that the reviewer acknowledged the comprehensive observational dataset, the encouraging performance of the ISBA-A-g_s model, particularly in simulating GPP, and the relevance of comparing conventional and alternate furrow irrigations for improving our understanding of ecosystem carbon-water trade-offs in irrigated maize systems. The reviewer's constructive comments have helped us further improve the clarity, organization, and scientific quality of the manuscript. We have carefully addressed all of the reviewer's comments and detailed point-by-point responses are provided.

However, I find that the manuscript in its current form does not yet clearly articulate its main scientific contribution. The dataset is valuable and the simulations appear promising, but the manuscript reads largely as an extensive model calibration and evaluation exercise rather than a tightly framed contribution to understanding ecosystem carbon-water coupling. I therefore recommend major revision.

- We sincerely thank the reviewer for this constructive and insightful comment. We have thoroughly revised the manuscript to better highlight its scientific novelty and contribution to understanding ecosystem carbon-water coupling. All these modifications can be found in the revised manuscript.
- Specifically, we have restructured the introduction to clearly establish the research gap and objectives, reorganized the results and discussion to focus on the underlying eco-

physiological mechanisms rather than model performance alone, and strengthened the conclusions to emphasize the broader scientific implications of the findings. In particular, the revised manuscript highlights how the ISBA-A-g_s model reproduces ecosystem carbon-water coupling across contrasting hydro-climatic conditions and captures the effects of irrigation management through process-based diagnostics, including underlying WUE (uWUE) and the EF-VPD relationship.

- We believe these revisions have significantly improved the scientific focus and clearly articulate the main contribution of the study.

Major comments:

1. The novelty and central contribution need to be clarified.

The manuscript currently presents its novelty in several different ways: (i) the first application of ISBA-A-gs in its MEB configuration to a semi-arid Indian maize system, (ii) an ecosystem-scale WUE assessment using a locally calibrated LSM under contrasting climates, partly motivated by a keyword-based literature gap, and (iii) the effect of irrigation management (CFI vs AFI) on carbon-water coupling. In my view, the third aspect is the most scientifically compelling contribution, but it is not developed as the main thread of the paper. A first application of an existing model to a new site is useful, but it is mainly incremental and may not provide sufficient novelty on its own. I strongly encourage the authors to define a single central research question, for example: can a process-based LSM reproduce and mechanistically explain irrigation-driven divergence in ecosystem WUE, and does this behavior differ between temperate and semi-arid maize systems? The manuscript should then be restructured around this question, with the CFI/AFI analysis and its mechanistic interpretation placed at the center.

- We sincerely thank the reviewer for this insightful and constructive comment. We agree that the scientific novelty of the original manuscript was not sufficiently articulated and that the central contribution needed to be more precisely framed. In response, we have thoroughly revised the manuscript to better highlight this central scientific contribution. The introduction has been rewritten to clearly establish the research gap and to define the study objectives around evaluating whether the ISBA-A-g_s model can realistically

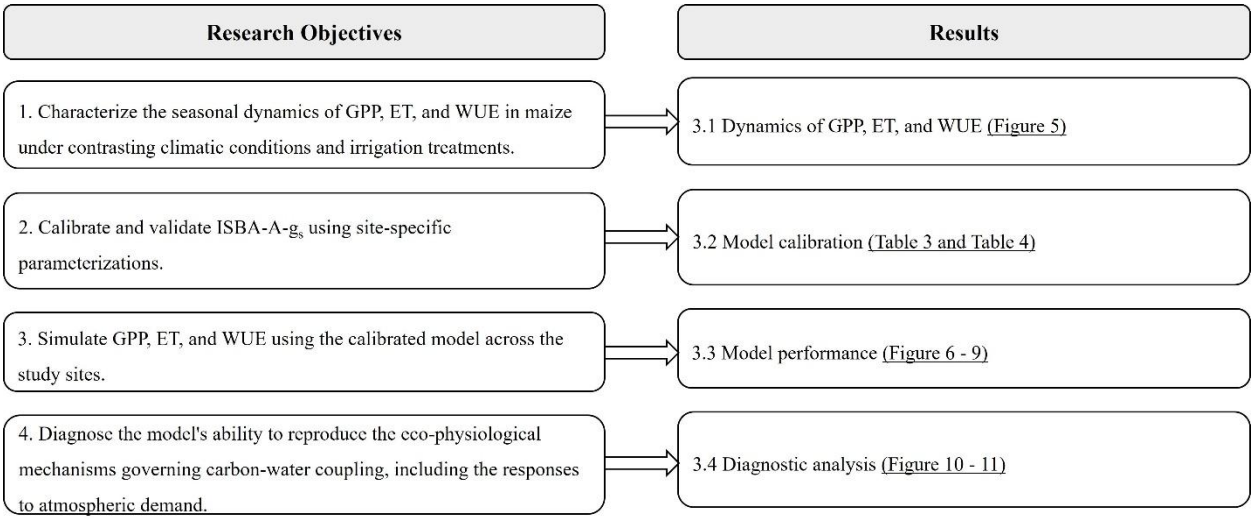
represent irrigation-driven variations in ecosystem GPP, ET, and WUE under contrasting hydro-climatic conditions. Accordingly, the introduction has been revised to clearly define this research gap and to position irrigation-driven carbon-water coupling as the central scientific theme of the study.

- To better support this objective, we have reorganized the results section into four complementary subsections.
- First, the dynamics of GPP, ET, and WUE under varying irrigation and climatic conditions now emphasizes site-specific responses and explicitly compares the divergence of ecosystem carbon and water fluxes between the CFI and AFI treatments (Section 3.1), thereby directly addressing the central research question.
- Second, the model calibration section has been revised to provide a process-based interpretation of the optimized site-specific parameters, explaining how differences between the CFI and AFI treatments, as well as between the tropical semi-arid (Ind-IITH) and temperate (FR-Lam) sites, influence carbon-water flux simulations (Section 3.2).
- Third, the model evaluation section now emphasizes not only the overall predictive performance of ISBA-A-g_s but also its ability to distinguish contrasting irrigation regimes and climatic conditions (Section 3.3).
- Finally, the diagnostic analyses based on underlying water use efficiency (uWUE) and the evaporative fraction-vapour pressure deficit (EF-VPD) relationship have been expanded to demonstrate how the model reproduces ecosystem carbon-water coupling and irrigation-induced differences across the two study sites (Section 3.4).
- Further, the discussion section has also been substantially revised to synthesize these findings and highlight their broader scientific implications. Rather than presenting the work primarily as a model calibration exercise or the first application of ISBA-A-g_s to a new region, the revised manuscript now emphasizes its principal contribution: demonstrating the capability of ISBA-A-g_s to mechanistically represent irrigation-driven ecosystem carbon-water interactions and WUE dynamics across contrasting temperate and tropical semi-arid maize agroecosystems. We believe these revisions have significantly strengthened the scientific focus and clearly articulated the main novelty and contribution of the study.

2. The manuscript is too long and repetitive.

The manuscript would benefit from substantial streamlining. The Introduction alone is very long (over 150 lines) and currently reads more like a broad survey than a targeted motivation for the study; it should be shortened and focused on the specific knowledge gap that this paper addresses. Similar redundancy occurs throughout the manuscript. Much of the Results section restates, in prose, values that are already shown in the figures and tables, including year-by-year and treatment-by-treatment GPP, ET, WUE, and performance metrics. The Discussion also frequently repeats the Results before developing broader interpretation. In addition, the site and instrument descriptions are highly detailed and partly overlap with information available in previous publications. I recommend that the authors condense the Introduction, move routine methodological or site details to tables, figures, appendices, or the Supplement, and focus the main text on the patterns, anomalies, and mechanistic interpretation that directly support the central research question. The two diagnostic analyses should either be more clearly differentiated in terms of their scientific purpose or streamlined if they lead to similar conclusions. A substantial reduction in length would greatly improve the clarity and readability of the manuscript.

- Agreed, and thank you for this valuable recommendation. We have substantially streamlined the manuscript and reorganized its structure to better emphasize the key scientific findings and their mechanistic interpretation.
- In the revised manuscript, the introduction has been substantially shortened to focus more clearly on the specific research gap, scientific motivation, and objectives of the study, while removing background information that was not directly relevant. Specifically, the introduction was reduced from 1,768 words to 1,207 words, while the overall manuscript was reduced from 15,937 words to 12,373 words. These revisions have helped improve the overall conciseness, focus, and readability of the manuscript.
- The results section has been reorganized into four subsections aligned with the study objectives as shown in below flowchart.



An illustrative diagram showing the sequence of results corresponding to the research objectives and the respective figure numbers associated with the description of results falling under individual research objectives.

- Descriptive text that merely repeated values presented in the figures and tables has been removed or substantially reduced, with greater emphasis placed on interpreting the major patterns, treatment differences, and site-specific responses.
- The discussion section has also been substantially revised to avoid repetition of the results and is now organized into three focused sections addressing (i) the implications of the model calibration, (ii) the model's capability to simulate ecosystem carbon and water fluxes under contrasting climates and irrigation treatments, and (iii) the underlying physiological and land-atmosphere mechanisms revealed by the diagnostic analyses. This restructuring places greater emphasis on the broader scientific implications of the findings rather than reiterating the results.
- The redundant descriptions of the study sites and meteorological conditions, which were previously presented in section 3.1, have been merged into section 2.1 to establish a clearer connection between the study objectives and the subsequent results. Similarly, unnecessary details regarding the instrumentation and methodology have been condensed, and overlapping descriptions have been removed where appropriate.
- Finally, the scientific purposes of the two diagnostic analyses have been clearly distinguished before presenting them as results (section 3.4). The uWUE analysis is now presented as a diagnostic of ecosystem carbon-water coupling, whereas the EF-VPD relationship is used to evaluate land-atmosphere coupling and surface energy partitioning

under contrasting irrigation and climatic conditions. Together, these complementary analyses provide independent process-based evidence of the model's ability to represent ecosystem carbon-water interactions.

- Overall, these revisions have substantially reduced redundancy, improved the organization and readability of the manuscript, and strengthened its scientific focus.

3. The calibration/validation strategy at Ind-IITH is unclear, and the dataset is insufficient for strong transferability claims.

The two sites are strongly imbalanced in data volume. FR-Lam includes six growing seasons, whereas Ind-IITH, which is presented as a key novel component of the study, includes only one year, with monsoon and winter seasons under CFI and AFI (Table 2). This limits the assessment of interannual variability at the Indian site and makes strong claims about model transferability across contrasting hydro-climatic regimes difficult to support. These claims should be tempered unless additional years are included or the associated uncertainty is discussed more explicitly.

More importantly, the calibration and validation design for Ind-IITH is unclear. Sect. 2.4 states that simulations were conducted for "four treatments (2 seasons)" at Ind-IITH during calibration, but also states that the optimized parameter set was validated using "Ind-IITH: two seasons" not included in the calibration phase. In addition, Table 6 reports separate optimized parameter values for CFI-Monsoon, AFI-Monsoon, CFI-Winter, and AFI-Winter. The authors should specify exactly which observations were used for calibration and which were used for validation, explain how independence between calibration and validation was ensured, and adjust the wording of the conclusions accordingly.

- We agree that the limited duration of observations at the Ind-IITH site (one agricultural year comprising monsoon and winter seasons under CFI and AFI) does not facilitate an assessment of interannual variability comparable to the six growing seasons available for the FR-Lam site. Consequently, we have revised the manuscript to temper statements regarding the transferability of the ISBA-A-g_s model across contrasting hydroclimatic conditions and explicitly acknowledge this limitation in section 5.0 of revised manuscript.

- Nevertheless, we emphasize that the Ind-IITH dataset was specifically designed to evaluate model performance under contrasting irrigation management (CFI and AFI) and seasonal climatic conditions within the same agricultural year. The inclusion of both monsoon and winter growing seasons provides the role of hydrometeorological conditions and enables a robust assessment of the model capability to represent irrigation-driven variations in ecosystem GPP, ET, and WUE.
- Furthermore, Figure 5, which presents the distribution of GPP, ET, and WUE using box plots, provides valuable insight into the intra-annual variability (FR-Lam), treatment-specific differences (Ind-IITH), and associated uncertainties in the observed and simulated fluxes. Rather than supporting claims of long-term transferability, these analyses help identify site-specific patterns, quantify variability within the available observations, and evaluate the model's ability to reproduce contrasting ecosystem responses under different irrigation treatments.
- Accordingly, we have revised the manuscript to clarify that the conclusions for the Ind-IITH site are restricted to the available observation period and should be interpreted as evidence of the model's capability under contrasting irrigation and seasonal conditions, rather than as a comprehensive assessment of long-term transferability across years.
- We agree that the calibration and validation strategy for the Ind-IITH site required further clarification. Accordingly, we have revised section 2.4 to describe the calibration procedure adopted for both study sites. For the FR-Lam site, the ISBA-A-g_s model was calibrated using multiple growing seasons and independently validated using the remaining seasons that were not included in the calibration, thereby ensuring independence between the calibration and validation datasets. In contrast, only one agricultural year of observations was available for the Ind-IITH site. Consequently, separate parameter sets were calibrated for each of the four irrigation-season combinations (CFI-Monsoon, AFI-Monsoon, CFI-Winter, and AFI-Winter) to investigate the effects of contrasting irrigation treatments and seasonal climatic conditions on ecosystem carbon and water fluxes. Because no additional independent observational dataset was available, an independent validation was not performed for the Ind-IITH site. We have now explicitly clarified this in the revised manuscript and corrected the previous wording, which may have incorrectly implied that an independent validation dataset was available. The purpose of deriving

separate parameter sets for the four irrigation-season combinations was not to demonstrate temporal transferability, but rather to quantify how model parameters and ecosystem processes respond to contrasting irrigation management and seasonal environmental conditions within the available experimental period.

4. The quantitative reporting needs to be made consistent.

Some key numbers are reported inconsistently across the manuscript. First, the sign convention for GPP is confusing. In the Abstract, GPP is reported as a positive cumulative value, for example 1039 gC m^{-2} at FR-Lam and 766 gC m^{-2} at Ind-IITH (p. 2, lines 33-38). However, in the Results, FR-Lam GPP is reported as negative, for example −8 to −11 gC m^{-2} day^{-1} in Sect. 3.2 and −900 to −1500 gC m^{-2} in Sect. 3.4 (p. 28-37, lines 614-617 and 778-780). At the same time, WUE is defined as GPP/ET and is always reported as positive. The authors should use one sign convention for GPP throughout the text, figures, and equations.

- In the original manuscript, GPP was reported as a negative flux following the conventional ecosystem carbon flux sign convention, where carbon uptake by the ecosystem is represented as a negative flux to indicate its direction. However, we agree that this sign convention has to be inconsistent with the quantitative definition of WUE, otherwise may cause unnecessary confusion for readers.
- In response, we have revised the manuscript to adopt a consistent sign convention, whereby GPP is reported as a positive throughout the manuscript, including the abstract, results, discussion, figures, tables, and equations. This sign convention is consistent with the definition of WUE presented in Equation 3. Accordingly, all daily (gC m^{-2} day^{-1}) and cumulative GPP (gC m^{-2}) values have been revised to positive values, and the associated figures have been updated to maintain consistency throughout the manuscript.

Second, some cumulative ET values do not match across sections. For example, FR-Lam ET is reported as about 610 kg H_2O m^{-2} in the Abstract, 500-800 kg H_2O m^{-2} in Sect. 3.4, and 800-1150 kg H_2O m^{-2} in the Discussion (p. 2, lines 33-35; p. 37, lines 788-789; p. 45, lines 1014-1015). If these numbers refer to different time periods or calculation methods, this should be clearly

explained. Otherwise, the values should be corrected. Overall, the authors should check all key GPP, ET, and WUE values in the Abstract, Results, and Discussion for consistency.

- Thank the reviewer for carefully identifying these discrepancies. The values reported in the abstract (610 kg H_2O m^{-2}) represent the mean cumulative ET across all six growing seasons at the FR-Lam site, whereas the values presented in Section 3.4 (500-800 kg H_2O m^{-2}) correspond to the minimum-to-maximum range of cumulative ET observed across the six individual growing seasons. We also agree that the ET values reported in the discussion (800-1150 kg H_2O m^{-2}) were inconsistent with those presented in the abstract and results. These values were inadvertently misreported and have therefore been removed from the revised manuscript to maintain consistency.
- In addition, we have thoroughly reviewed and cross-checked all key GPP, ET, and WUE values reported throughout the manuscript to ensure complete consistency.

Minor comments:

1. Please check the use of "correspondingly" in the Abstract. "respectively" would be more appropriate in most cases.
    - Agreed. The abstract has been revised accordingly.

2. Line 138: the citation "(Boone et al., 2017)" should be Boone et al., (2017).
    - Agreed. This has been corrected, and all narrative citations have been checked throughout the manuscript.

3. Please check whether "leaf are index" in the caption of Figure 4 should be "leaf area index".
    - This is a typo and is corrected in the captions of Figures 2 and 4.

4. The initial value of mesophyll conductance (gm) is given as 7.53×10^{-2} m s^{-1} in the text (Sect. 3.3) but as 7.53×10^{-3} m s^{-1} in Table 5. Please reconcile.
    - Agreed. The incorrect text has been corrected to match the values reported in Table 5.

5. The unit for WUE is written inconsistently, e.g., "g C kg H_2O^{-1}" in Eq. (3) versus "gC kg^{-1} H_2O" elsewhere. Please standardize unit and symbol notation throughout the text, equations, tables, and figures (including spacing, e.g., "gC" vs "g C").
    - The WUE unit and notation have been standardized throughout the manuscript as "gC kg H_2O^{-1}"

6. The manuscript would benefit from a thorough English-language edit; there are recurrent issues with articles, tense, and phrasing that occasionally impede readability.
    - The manuscript has been thoroughly proofread and professionally edited to improve grammar, clarity, and readability.