

Response to Reviewers

We sincerely thank the editor and both reviewers for their careful evaluation of our manuscript and for the constructive comments that helped us further improve the quality and clarity of the paper. Below, we provide our point-by-point responses. Reviewer comments are shown in *italic*, and our responses follow.

1. Response to Reviewer #1

1.1. General evaluation

We sincerely appreciate the reviewer’s positive assessment of our work, including the model design, structural constraint, ablation experiments, and computational efficiency. We are encouraged by this recognition.

1.2. Code and data availability

Code/Data Availability. The appendix declares access to code/data, but authors must confirm their actual functionality (I did not test them, though future users in the field may verify reproducibility)

Response: We fully agree with the reviewer on the importance of reproducibility. In this revision, we have taken the following steps to ensure clarity and usability:

1. **Comprehensive README documentation.** The repository now contains a clear and structured README.md, including data download instructions, typical training/validation/testing commands, and detailed explanations of each component. This ensures that readers can follow the workflow without ambiguity.

2. **Verified executable workflow.** We uploaded sample test data and verified, in a fresh environment, that the entire workflow—training, validation, and testing—runs smoothly from start to finish using the provided scripts.

3. **Encouraging reproducibility and feedback.** We warmly welcome readers to reproduce our results using the public repository. Should any issues arise, users are invited to open a GitHub issue or contact us via email, and we will be happy to assist.

1.3. Language and formatting

“Language/formatting. The authors should carefully proofread the entire manuscript for grammar and spelling errors. I have already identified a few issues. (e.g., ‘contrained’ should be ‘constrained’ in Line 25; ‘Table ??’ in Line 136).”

Response: We thank the reviewer for pointing this out. We have conducted an additional proofreading pass, correcting spelling mistakes, unifying terminology, refining figure/table references, and improving clarity where needed.

2. Response to Reviewer #2

2.1. Overall evaluation and previous improvements

We sincerely appreciate the reviewer’s detailed assessment and are pleased that the improvements made in the previous revision—including clarifications on sampling strategy, weighted loss motivation, significance testing, MS-SSIM rationale, overall section organization, and case-study interpretation—are now satisfactory.

2.2. On the remaining concern regarding comparison with simpler classical methods

Despite these important improvements, the comparison with simpler and more classical methods remains limited. While MSEM is an appropriate baseline within operational ensemble post-processing, it does not fully represent the family of low-complexity statistical or physically informed approaches that could serve as alternative benchmarks (e.g., locally weighted regression, analogue methods, or elevation-adjusted interpolation). The justification for adopting a GAN-based framework therefore still rests primarily on empirical performance rather than on a clear demonstration that simpler, transparent models would fail under similar conditions. I recognize, however, that the authors have made a sincere and substantial effort to strengthen the paper, and that the present version is technically sound and clearly written. My remaining comment should therefore be understood as a recommendation for future work rather than a condition for acceptance. The manuscript can be accepted after minor editorial polishing. Nevertheless, I would encourage the authors to explicitly acknowledge in the discussion that a more systematic comparison with classical statistical or regression-based methods could further consolidate the argument for using GANs in this context.

Response: We fully agree with the reviewer’s observation. We acknowledge that the current study focuses primarily on comparing GFRNet with major NWP models and a representative operational linear ensemble approach (MSEM). The broader family of simple classical methods is not exhaustively explored in this manuscript.

To directly address the reviewer’s suggestion, we have added a dedicated paragraph in the **Discussion** section explicitly acknowledging this limitation. In the same paragraph, we state that:

- incorporating a wider set of classical, low-complexity approaches is an important direction for future research;
- systematic comparisons in a unified evaluation framework (including TS/FSS/BIAS/MS-SSIM and significance testing) will further strengthen the justification for using a GAN-based approach;
- hybrid strategies combining classical methods with deep learning are also promising and will be explored in future work.

We sincerely appreciate this insightful recommendation and have clearly integrated it into the revised manuscript.

2.3. Editorial polishing

Minor language and formatting refinements are recommended.

Response: We have performed additional editorial polishing throughout the manuscript, improving clarity and maintaining consistency in notation, terminology, and formatting.

Conclusion

We again express our sincere gratitude to both reviewers for their thoughtful and constructive feedback. The revisions made in response to their comments have strengthened the manuscript substantially. We hope that the current version meets the expectations of the reviewers and the editor.