

Summary of the response letter in the stage of technical corrections

Mapping Three Decades of Urban Growth in China: A 30 m Annual Building Height Dataset (1990 – 2019)

Dear Editor and Reviewers,

Thank you for allowing us to respond to the reviewers' valuable comments during the technical corrections stage. We are pleased that the manuscript has been accepted with corrections, and we sincerely appreciate the constructive suggestions that help improve our analyses and the paper. We carefully and extensively revise our manuscript to account for the reviewers' recommended changes. We believe the revised manuscript accounts for all the reviewers' comments, and it is significantly improved as a result. We provide detailed responses to all questions and recommendations from the editor and reviewers in the attached letter.

Sincerely yours,

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Reviewer #1

The author has comprehensively revised the manuscript and updated the dataset, which has addressed most of my previous concerns. I acknowledge that the limited training samples restrict the spatial generalization ability of the model and lead to the underestimation of high-rise buildings.

We sincerely thank the reviewer for the positive evaluation of our revised manuscript and for acknowledging the improvements made to the dataset and analysis. We also greatly appreciate the insightful and constructive comments, particularly regarding data quality, model robustness, and validation, which have helped us further clarify and strengthen the study. In the following sections, we address each of the reviewer's points in detail, organizing our responses in a question (black)-response (blue)-original (red) format to ensure clarity.

For future dataset updates, it is recommended to introduce multi-source training data, such as airborne LiDAR data. Its extensive spatial coverage can effectively improve the above-mentioned generalization limitation.

Thank you for this valuable suggestion. We agree that incorporating additional high-quality reference data sources, particularly airborne LiDAR data, could further improve model generalization and reduce biases in high-rise building estimation. In the revised manuscript, a dedicated statement has been added in Section 6 "Conclusion and future work" to explicitly acknowledge this direction and highlight its potential to enhance robustness in complex urban environments.

" ...

For future dataset updates, incorporating multi-source training data, such as airborne LiDAR observations, could be beneficial. LiDAR data provide more direct and accurate height measurements, which may help alleviate current limitations in spatial generalization and reduce the underestimation of high-rise buildings, thereby further improving model robustness in complex urban environments (Chen et al., 2025; Ma et al., 2024).

..."

Some minor revisions are recommended as follows.

1. Introduction: "Optical remote sensing data generally exploit shadows and morphological profiles to extract buildings of various heights." This seems to refer to extracting building heights. Suggest changing to "extract heights of various buildings."

Thank you for the suggestion. We agree that the original phrasing was ambiguous, and we have revised it accordingly. We have also carefully checked the manuscript to ensure consistency and no similar issues remain elsewhere.

" ...

Optical remote sensing data generally exploit shadows and morphological profiles to extract heights of various buildings

..."

2. "He et al. (2023) produced a China's 30 m resolution building height dataset from 1990 to 2010..." Should "China's" be "global"?

Thank you for pointing this out. You are correct that the original wording was inaccurate. We have revised “China’s” to “global” to correctly reflect the scope of the dataset described in He et al. (2023). We have also carefully checked the manuscript to ensure that no similar inconsistencies remain elsewhere.

“ ...

He et al. (2023) produced a China's global 30 m resolution building height dataset

...”

3. Several terms are used repetitively, e.g., "satellite remote sensing data," "remote sensing imagery," and "remote sensing images." I suggest using "satellite data" and "satellite imagery" consistently.

Thank you for this helpful suggestion. We have carefully reviewed the terminology throughout the manuscript and improved consistency.

In general, usage is unified by replacing “images” with “imagery” for greater technical precision. Terms are also standardized where appropriate as “satellite data” and “satellite imagery,” while retaining “satellite remote sensing data” in selected places to emphasize the connection between satellite observations and remote sensing methodology. This balance improves both consistency and conceptual clarity without losing the intended emphasis on data sources. An example revision (end of Section 1 Introduction) is:

“...Finally, the accuracy of long-term building height mapping is evaluated through comparisons with existing datasets and historical satellite imagery...”

4. Add spaces between numbers and units throughout the manuscript (e.g., “30m” → “30 m”).

Thank you for this careful observation. Formatting throughout the manuscript is corrected by adding appropriate spaces between numerical values and units (e.g., “30m” → “30 m”) to ensure consistency with standard scientific writing conventions.

“...World Settlement Footprint (WSF) dataset, initially at 10 m spatial resolution, is resampled to 30 m to match our analytical grid...”

5. The manuscript uses various terms for building height estimation interchangeably ("building height regression," "building height prediction," "building height

mapping," "building height estimation"). For precision, please unify to a single term throughout.

Thank you for this suggestion. All terminology has been unified to "building height mapping" throughout the manuscript, as the focus of this study is large-scale building height mapping. An example revision in Section 3.1.2 is:

“...and the regressed VV backscatter is utilized as an independent variable in subsequent XGBoost-based models for building height mapping...”

6. Figure 1 caption: "Number of sample pixels in 2019 in every sampled city." The Baidu Maps building floor data are footprint-based. Does "sample pixels" refer to the rasterized building height labels? If so, citing Figure 1 at "The 2019 reference data for building heights are derived from building footprint records of that year from Baidu Maps, covering 59 Chinese cities (Fig. 1)" may be inappropriate—it would be more appropriate to reference Figure 1 where the building height label generation is described.

We appreciate the reviewer's careful observation. Since Fig. 1 counts rasterized pixels rather than footprint-based labels, so placing it under the footprint description was not appropriate. Following this suggestion, Fig. 1 is relocated to the end of Section 2.6, where it now serves as a summary after the rasterization steps are fully described.

“...After these procedures, the 2019 reference height dataset contains 9,870,241 sample pixels across China, with the largest city contributing 1,165,620 pixels (Fig. 1)...”

7. "30mx30m area"—do not use "x"; use the standard multiplication symbol "×", and "area" seems odd here.

Thank you for this precise comment. We agree that both the notation and the wording needed improvement. The ASCII “x” is replaced with the standard multiplication symbol “×” throughout the manuscript, and the wording is revised to avoid the ambiguous use of “area.” In this context, the corresponding unit is consistently referred as “pixel,” which better matches the definition in the underlying formulation.

“...averaging the value of every $1\text{ m} \times 1\text{ m}$ pixel within the $30\text{ m} \times 30\text{ m}$ pixel...”

8. "the sum of=height values..."—likely a typo.

Thank you for pointing this out. We apologize for the typographical error. It has been corrected in the revised manuscript. We have also carefully re-checked the entire document to ensure that no similar typos remain.

“...the numerator is equivalent to the sum of height values over building-covered sub-pixels only....”

9. Revise the punctuation error in “four main steps (Fig.2):” → “four main steps (Fig.2).”.

Thank you for this careful correction. We apologize for the punctuation oversight. The sentence is revised accordingly and the entire manuscript is reviewed to correct similar punctuation inconsistencies wherever they appeared.

“... The proposed method consists of four main steps (Fig.2). ...”

10. The term “urban growth” is not rigorous, as urban areas include many land cover types beyond buildings. Suggest "urban building growth."

Thank you for this helpful suggestion. We agree that the terminology should better reflect the actual content of the study. Accordingly, “urban growth” is revised to “urban building growth” to more precisely describe the focus on building-level dynamics rather than general urban land-cover expansion.

Text in Section (d) of Fig. 2 is also changed accordingly to “Urban Building Growth and Renewal Analysis”.

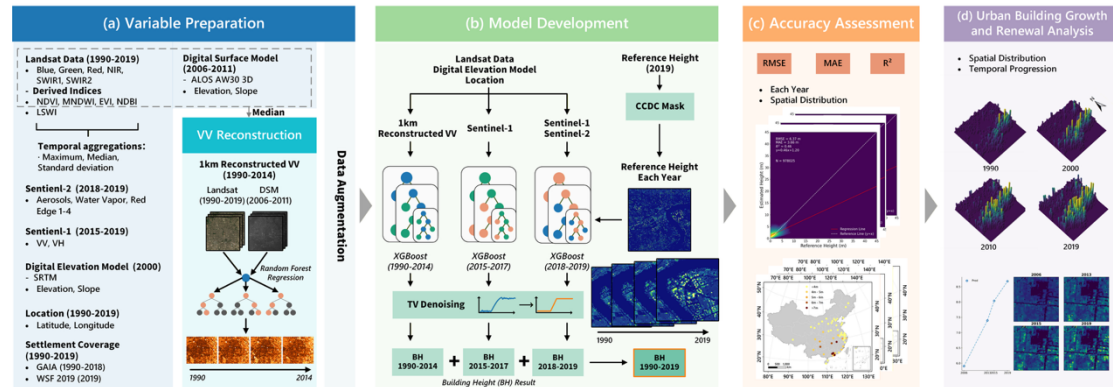


Figure 1. Updated Fig. 2 in the revised manuscript.

11. Standardize numeric formats throughout the manuscript (e.g., “9870241” → “9,870,241”; “2293565” → “2,293,565”).

Thank you for this helpful suggestion. We agree that consistent numeric formatting improves readability and clarity. All large numbers have been standardized throughout the manuscript by using comma-separated formatting (e.g., “9870241” → “9,870,241”). An example revision in Section 4.1 is:

“The original reference height in 2019 has a total of 9,870,241 sample pixels. ...”

We have also carefully checked the entire manuscript to ensure consistent application of this formatting.

12. Unify the relevant nouns in text and figures. The manuscript uses “building heights” while Figure 7 uses “built-up height”.

We sincerely thank the reviewer for catching this inconsistency. We have corrected "built-up height" to "building height" in Fig. 7 to match the terminology used throughout the manuscript.

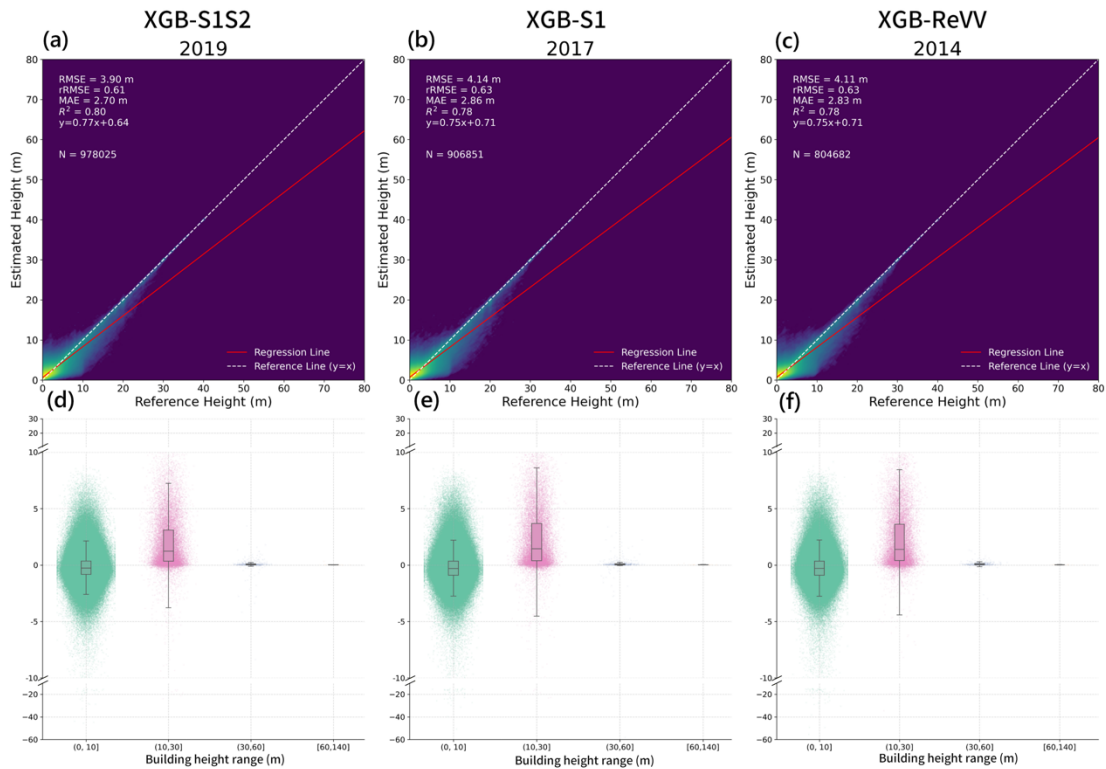


Figure 2. Updated Fig. 7 of the revised manuscript.

13. Figure 8 caption lists "(a) RMSE; (b) MAE; (c) R²" but the order of the subfigures differs.

Thank you for this careful observation. Figure caption is corrected so that the order of the metrics now matches the actual subfigure layout, ensuring full consistency between the text and the visual presentation.

“...Figure 8. Distribution of accuracy indices across cities in 2019. (a) R²; (b) RMSE; (c) MAE.....”

14. Figure 11: the year order seems odd—consider reversing it.

Thank you for this suggestion. We carefully reviewed Fig. 11 in the original manuscript (Fig. 15 in the revised manuscript) and confirmed that the years are presented in the correct order.

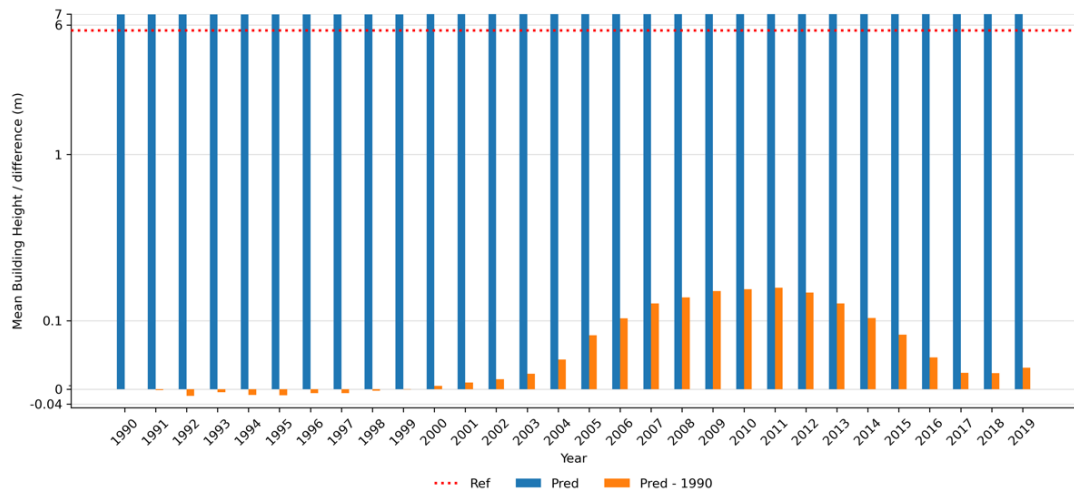


Figure 3. Updated Fig. 15 of the revised manuscript.