Enhancing High-Resolution Forest Stand Mean Height Mapping in China through an Individual Tree-Based Approach with Close-Range LiDAR Data

Dear Editor and Reviewer:

On behalf of my co-authors, we thank you very much for giving us an opportunity to revise our manuscript, and we also appreciate reviewers very much for their positive and constructive comments and suggestions on our manuscript entitled "Enhancing High-Resolution Forest Stand Mean Height Mapping in China through an Individual Tree-Based Approach with Close-Range LiDAR Data" (Manuscript Number: essd-2024-274).

We revised the manuscript according to these comments and suggestions. All changes were marked in highlight text in the revised manuscript. The line numbers in the response are the corresponding line numbers in the revised version.

Once again, thank you very much for your comments and suggestions.

Comment 1: Line 22: deleted estimation.

Reply 1: Thanks to reviewer for reminder, the estimation has been deleted in the Abstract. Please refer to Line 21-22 for details.

Comment 2: Line 45: The author used arithmetic mean height (ha) and weighted mean height (hw) to represent Forest Stand Mean Height. The similarities and differences between these two metrics should be explained at the beginning of the Introduction.

Reply 2: In the introduction, we described the differences in calculation methods and the similarities in application directions. The detailed similarities and differences were explained in the formula section and discussed in the discussion section.

The differences:

Forest stand height denotes the mean height of trees within a stand/plot, including arithmetic mean height and mean height weighted in proportion to their basal area (weighted mean height or Lorey's mean height) (Laar and Akça 2007; Masaka et al. 2013). Please refer to Line 45-47 for details.

The similarities:

It serves as a key factor in assessing forest growth (Ma et al. 2023; McGregor et al. 2021), calculating forest volume (Xu et al. 2019) and carbon storage (Yao et al. 2018),

as well as guiding sustainable forest management practices (Xu et al. 2023). Please refer to Line 47-48 for details.

Comment 3: Line 69: I think there's an extra 'from' written here, delete it.

Reply 3: We are very sorry for our incorrect English expression; we have made correction after checking. Please refer to Line 69-70 for details.

Comment 4: Figure 1 presents the content comprehensively; however, the four images in step 4 are not very clear, making it difficult to see the legend details. I suggest improving their clarity. I also noticed that these four subplots might be the same as the product images and uncertainty analysis figures shown later. Adjustments could be made accordingly.

Reply 4: We thank the reviewer for pointing out this issue. The legend and uncertainty analysis figures in Figure 1 have been adjusted.

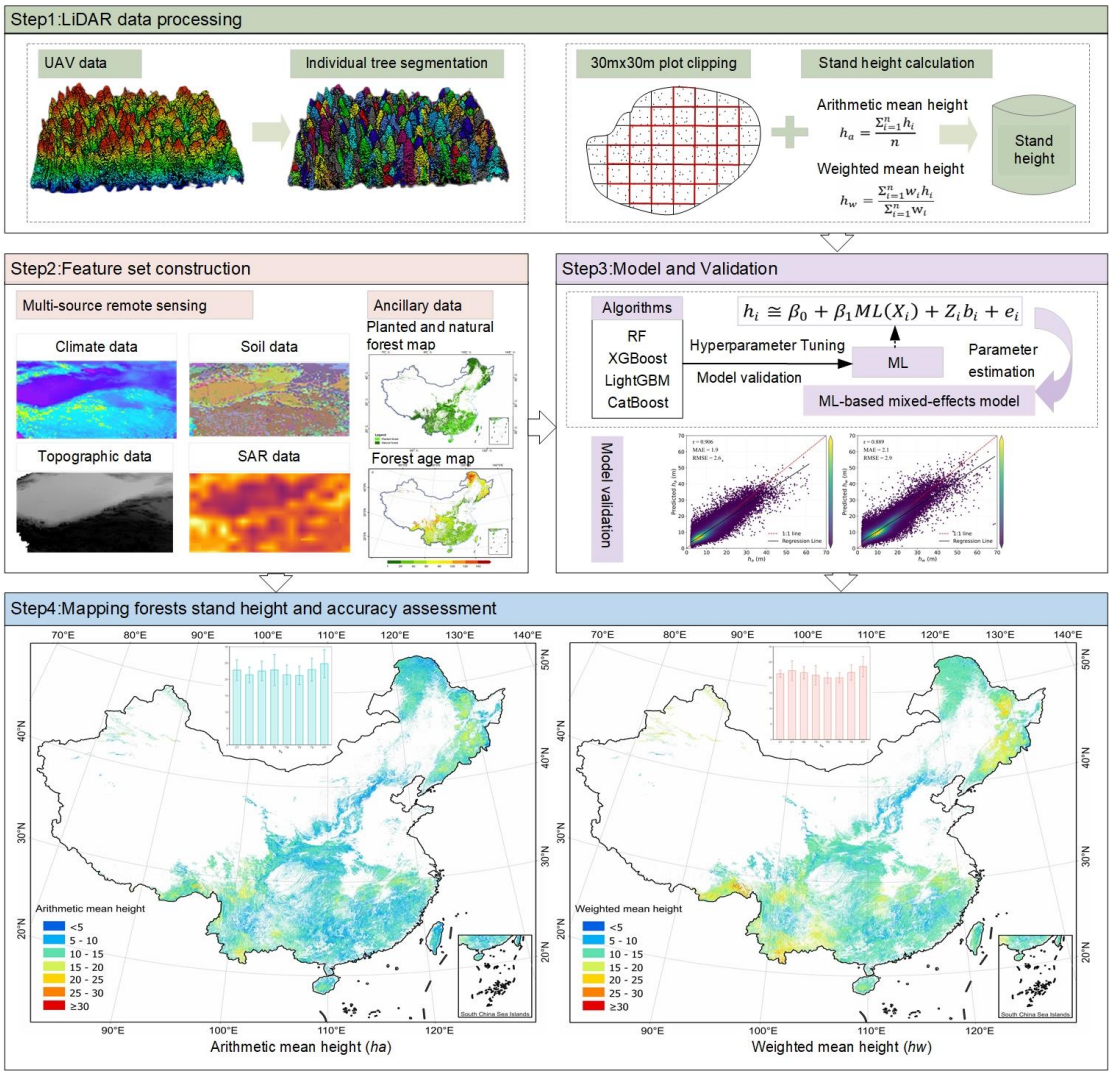

Figure 1: Workflow adopted for the modeling and mapping forest stand mean heights ($\boldsymbol{h_a}$ and $\boldsymbol{h_w}$) at 30 m resolution across the China's forest. Publisher's remark: please note that the above figure contains disputed territories.

Comment 5: Although UAV LiDAR point density is generally high, it still affects the extraction of forest attributes to some extent. Therefore, in Table 1, it would be helpful to add point density values under commonly used UAV flight parameters. This will provide a better introduction to the data, and I recommend adding this column.

Reply 5： We thank the reviewer for pointing out this issue, and we have done it according to your ideas. Please refer to Table 1 for details.

Comment 6: Table 2, Proportion of forest area covered by drone lidar data, is this value the ratio of the area where data was collected to the forest area in different Vegetation divisions?

Reply 6: Yes. For clearer explanation, we have further added note explanations. Please refer to Table 2 for details.

Comment 7: A figure should be added to Section 2.2 to visually present the field data distribution?

Reply 7: Thank you for the reviewer's reminder. Considering that field data and lidar data display more clearly, we have added the field data distribution in Supplementary Figure S1. Please refer to supplementary Figure S1 for details.

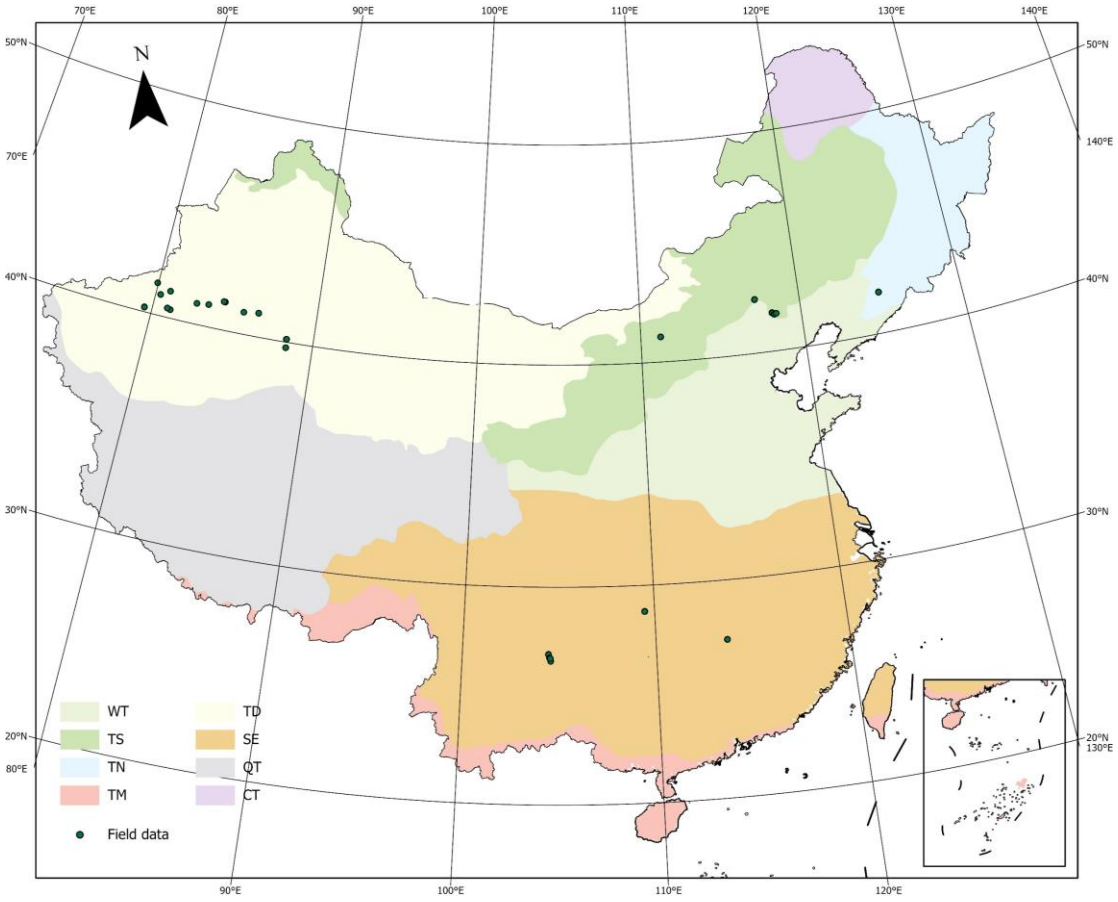

Figure S2:Field samples collected for weighted mean height calculation and product validation.

Comment 8: Line 156: I noticed that each plot of field data covers an area greater than 400 square meters, while your product has a resolution of 30 meters. Could this discrepancy affect the validation results?

Reply 8: In China's forest resource surveys, the differences in plot size have a minimal impact on the accuracy of stand height estimation mainly due to a sufficient number of samples, flexibility in plot size and shape, relatively stable forest structures, data standardization processes (Lohr, S. L. 2000; Gregoire, T. G., & Valentine, H. T. 2008; Paul TSH, et al.2019).

Certainly, due to time and labor cost constraints, there are some limitations in the sample data collection for this study, which have been addressed in the manuscript. Please refer to Line 165-166 for details.

References:

Lohr, S. L. (2000). Sampling: design and analysis. Technometrics, 42(2), 223-224.

Gregoire, T. G., & Valentine, H. T. (2008). Sampling strategies for natural resources

and the environment. international journal of environmental analytical chemistry.
Paul TSH, Kimberley MO, Beets PN. Thinking outside the square: Evidence that plot shape and layout in forest inventories can bias estimates of stand metrics. Methods Ecol Evol. 2019; 10: 381–388. https://doi.org/10.1111/2041-210X.13113

Comment 9: Figure 3 only shows the weighting method for $w2$, has a comparison been made between the weighting of $w1$ and $w2$?
Reply 9: In Supplementary Table S4, we have compared the deviations between weighted mean heights with different weights ($w1$ and $w2$) and Lorey's mean height (national forest inventory data). Please refer to supplementary Table S4 for details.

Comment 10: Line 197: delete 'those'.
Reply 10: We are very sorry for our incorrect writing and it is rectified. Please refer to Line 204 for details.

Comment 11: In Section 2.5.2, the referenced section should be Section 2.5.1, not Section 2.4.1.
Reply 11: Thank you for the reviewer's reminder, we have revised this error. Please refer to Line 248 and 258 for details.

Comment 12: In Figures 10 and 11, the uncertainty is given in percentage (%). The unit of ε_{hi} should be specified in the Methods section.
Reply 12: We appreciate it very much for this suggestion, and we have done it according to your ideas. Please refer to Equations 16-20 for details.