The authors would like to thank the editor and reviewers for their comments, which have helped improve the scientific quality and clarity of the manuscript. Below, we respond to the feedback from the editor and the reports provided by the reviewers. The responses are highlighted in blue.

Below, we respond to the **3 points** that the Editor suggested to improve in the revised manuscript version.

1) The quantitative results do not match the authors' conclusions described in the text. While I do think this method can be published in some form as an attempt to predict olive tree biomass, I think it is a much more negative result than the authors are expressing. Potentially, the paper should be about an estimation of the error or uncertainty of olive biomass with the best remote sensing tools we have and/or about how we currently don't have sufficient tools to predict this data at large scales. I'm not sure we can draw such confident conclusions from the analysis as stated in lines 19-20 and 475-476 for example, especially based on the results shown in the figures. The overarching statements that model performance up to R2 of 0.56 R2 in line 634 is misleading when showing several times lower performance values for independent lidar references (less than 0.14). This is described more in the second point. The lack of sufficient comparison with independent, reference LiDAR data is a major concern. It seems like the authors still express some confidence in the approach despite very low fit values, which is misleading to someone reading the abstract.

We fully agree with the reviewer's comment. In some sections of the original manuscript, the predictive model was described as providing a relatively accurate solution for biomass quantification in olive orchards. We have revised these parts of the text to avoid any potential misunderstanding or overstatement. Specifically, the sentences mentioned by the reviewer (lines 19–20 and 475–476) have been rewritten, along with other passages that could lead to confusion or be perceived as overly optimistic. All these changes are highlighted in the "Track-Change" document.

Regarding the R^2 value of 0.56 mentioned in the manuscript, this corresponds to a different analysis than the one performed for the validation with ALS data. That value refers to the internal predictive performance of the Random Forest model, evaluated using a 25% validation subset derived from the volumetric modeling framework. This process is described in lines 138–139 and further detailed in lines 351–356. Initially, we considered removing this validation method. However, we concluded that while it may not be the most objective approach, it is useful for understanding RF's performance with internal model validation. We have therefore decided to retain it in the manuscript. Nonetheless, we emphasize that the ALS validation is the most valuable one in our study.

Additionally, we have clarified in the revised Discussion that the low correspondence with ALS data highlights the current limitations of GEDI and optical-radar inputs for low-stature vegetation. The revised text now emphasizes that the proposed framework should be interpreted as a methodological exploration rather than a fully accurate operational model.

2) The validation data as GEDI L2 data seems circular and/or insufficient for the application here. It appears the validation data still appear to be a version of GEDI which is highly circular considering it is used as one predictor. This issue was raised in the first round by both reviewers as a major concern. In my decision in the first round, I mentioned that this should be sufficiently addressed. However, the authors still use GEDI as the reference here and based their main conclusions mostly on these results, which does not appear appropriate (it appears to be both a regressor and reference data for training). In this next round, the new reviewer also brought up this issue, and I also agree this is a concern. Given consensus of concern from several reviewers, this issue needs to be addressed given that many readers will likely take issue with this. The main issue is that while the values are higher in the top part of figure 4, these are both error prone data to compare to and is a bit circular to have predictors be the same as predicted. Or if this is not the case that GEDI L2 data are both being used as reference and as a predictor, then it was still not clear what predicted and predictor data are being used (please note that it is still quite challenging to determine what the reference/validation data are). It ultimately needs to be more clearly motivated why this approach is chosen.

We agree that the validation approach in the first version of the manuscript was not sufficiently robust. For this reason, in the revised version we have included an independent validation using ALS data, which are free from the uncertainty associated with GEDI-derived measurements. However, it is important to clarify that the validation section now includes two separate analyses:

1- Internal model validation using GEDI L2A-derived data (25% of the total training samples shown in Figure 3). We acknowledge the concern regarding potential data circularity, but we emphasize that the GEDI-based validation set was never used during model training. It was exclusively reserved to evaluate model performance using the predictor variables listed in Table 2. Importantly, none of these predictors include GEDI height metrics; GEDI L2A data and derived sub-products ('canopy cover' and 'Tree Density') were only used to construct the training dataset (i.e, as the source of reference biomass information), not as input variables for model prediction.
2- Independent model validation using ALS data. This represents the most reliable and independent validation dataset in our study. We have clarified throughout the revised manuscript that this validation provides the main quantitative benchmark of model performance.

In addition, several sentences have been reworded in the "Methodology" and "Results" sections to better distinguish these two analyses and to explicitly highlight the significance of the ALS-based validation as the definitive assessment of the model's predictive accuracy.

3) As the reviewers pointed out in the first round, and so does the new expert reviewer, GEDI's waveform approach will struggle with trees that are near the height of the noise level. The authors do not appear to sufficiently address this point in the text about GEDI's use here. As the new reviewer pointed out, the GEDI instrument's noise level is around a few meters and olive trees may be near this height. I do think it is possible for GEDI to detect these olive trees (especially if nearing 10m), but the uncertainty bar will be higher. This issue needs to be sufficiently addressed in this paper (especially as a major discussion point), and especially why this issue is not mitigated by use of other data sources (optical and active microwave).

We appreciate the reviewer's insightful comment, which raises a highly relevant concern that has significantly improved our analysis and discussion. In this revised version, we have analyzed the GEDI L2A training dataset by extracting the Relative

Height (RH) percentiles for all footprints and examining the internal distribution of canopy height metrics. A new Figure 4 has been added to illustrate this analysis: Figure 4a shows the mean relative height waveforms for different olive tree height classes, while Figure 4b displays the percentile at which the first RH value greater than zero occurs for all training points. This metric serves as a useful indicator of waveform noise and allows us to assess its variation across vegetation height classes.

This analysis confirms that waveform noise strongly affects lower vegetation and supports our decision not to use the GEDI L2B "Canopy Cover" product in the training dataset due to its high uncertainty for low-stature trees.

We have incorporated a detailed explanation of this analysis in Section "3.1. Training Phase: Biomass Modelling Framework for AGBD Inputs and Relative Height Metrics Assessment" (lines 424–439). In addition, a more extensive discussion of these findings has been added in Section "4.1. Model Performance and Data Integration" (lines 555–579), where we address the limitations of GEDI for detecting short canopies and the implications for biomass estimation in olive orchards.

Finally, we note that this limitation makes it challenging for the model to fully exploit the potential of optical and SAR variables within the current framework. This is because the AGBD modelling approach (as shown in Figure 1) relies exclusively on the three predictor variables derived from the volumetric model, which are themselves based on the GEDI reference dataset. Consequently, the training data are inherently biased toward GEDI-related structural information and subproducts ('Canopy Cover' and 'Tree Density'), making it difficult for the model to fully exploit the complementary potential of optical and radar variables. To fully benefit from multi-source integration, the entire modelling framework would need to be redesigned to incorporate these data sources more explicitly. It is explained in lines 706-711.

Finally, note that R2 values, by definition, can't be negative (in figure 4).

We appreciate this observation. By definition, the coefficient of determination (R^2) cannot take negative values when calculated as the square of the Pearson correlation coefficient. The negative value initially reported was due to the use of the "coefficient of determination" as returned by the python function "sklearn.metrics.r2_score", which can produce negative values when the predictive model performs worse than the mean predictor.

Anonymous Referee #2

The authors of the paper have done a good job of taking the two reviewers' suggestions from the first round of reviews into consideration. They have made important improvements that enhance the quality and clarity of the work. Nevertheless, I believe it is necessary to make some recommendations to clarify certain sections of the text.

Ideally, there would be a map of the study area, or at least a list of the countries to be analysed (those in Figure 5).

We initially considered including a map or a detailed list of countries. However, to keep the manuscript concise and focused, we decided not to add additional figures. We believe that the current textual description of the study area provides sufficient contextual information for readers to interpret the analyses presented in Figure 5.

Furthermore, the table shown in Figure 6 contains all the countries analyzed, so we believe it is quite clear.

In the new methodology section, ALS data are used; a description of these can be found from line 319 onwards. These data should be described earlier, in section 2.3 Data sources and preprocessing, and the date should be indicated, as well as the implications that the date difference with the rest of the data could have.

We appreciate this constructive suggestion. In the revised version, we have added a new subsection titled “2.3.4. Airborne LiDAR Scanning (ALS) Data”, where the ALS dataset is introduced earlier in the manuscript.

Lines 131 and 132: The idea of estimating AGBD from GEDI L2A is repeated.

Corrected: “The proposed framework derives AGBD estimates from the GEDI L2A product (Dubayah et al., 2021)”.

Line 273: 'was applied' is missing.

Corrected: “This WD value was applied as a constant to convert volumes into biomass units.”

Line 323: ')' is missing.

Corrected

Anonymous Referee #3

This study uses Random Forest method to predict the biomass of Mediterranean olive orchards with multi-source remote sensing data, including lidar, optical, and SAR datasets. The study goal is to determine the most effective combination of RS features for biomass estimation. The conclusion is to include all sources that were proposed in this study. However, I suggest rejecting this manuscript due to the following reasons:

• The height of olive orchard is generally smaller than 5m (Fig3.b). GEDI’s waveform FWHM is about 5m. Olive orchard’s height is below the limit of GEDI sensor. The heights of olive orchard in this study ranges from 2 to 5m. GEDI will not be sensitive to such small changes. This is also the reason why R2 is only 0.16 in the result.

We fully acknowledge this limitation. In this revised version, we have included additional analyses and discussion specifically addressing this issue (Figure 4). We agree that the relatively low canopy height of olive orchards, close to the GEDI sensor's detection threshold, is one of the main reasons for the reduced predictive accuracy observed. However, the main objective of this study is not to present a definitive model for biomass estimation in low-stature vegetation, but rather to provide a theoretical framework that evaluates the feasibility and limitations of using GEDI-derived height metrics for such ecosystems. In this sense, our results should be interpreted as an exploratory assessment that highlights both the current constraints and the potential for improvement with future advances in remote sensing instrumentation.

• Canopy cover is already product in GEDI L2B. The authors used a single index – SAVI to predict canopy cover. It doesn't make sense.

We understand that not using the GEDI L2B "Canopy Cover" product might seem counterintuitive. However, our analyses showed that this product performs poorly for low-stature vegetation such as olive orchards. In contrast, using a canopy cover estimate derived from spectral indices (specifically SAVI) provided more consistent results. Furthermore, our assessment of the GEDI waveforms, including the distribution of relative height percentiles, revealed significant inaccuracies in the L2B product for short vegetation canopies. These findings reinforced our decision to exclude the GEDI L2B "Canopy Cover" product and rely instead on alternative optical-based predictors better suited to this type of ecosystem.

• The value of AGBD is from 0 to 50 Mg/ha. The value is small, and variance is also small. It is difficult to tell the difference in model performance. In "Figure 1. Density plots for the regression model AGBD estimation", the R2 is only 0.14, also too low when validating with reference datasets.

The AGBD range may appear low compared to other forest species. However, the upper limit of 50 Mg/ha was selected because it represents a realistic threshold for olive orchards, as olive trees rarely exceed this biomass value per hectare. This range is consistent with previous studies and field-based assessments of olive biomass. The relatively small variance is therefore inherent to the structural characteristics of olive trees rather than a limitation of the dataset itself.

Regarding the low R2 value, we fully acknowledge that the model performance is limited. Nevertheless, this study is intended as an exploratory assessment rather than a definitive biomass estimation approach. Its main goal is to evaluate the feasibility of using GEDI-derived height metrics within a volumetric modelling framework, to test different multi-source remote sensing combinations, and to discuss the inherent limitations of GEDI measurements over low-stature and cultivated vegetation.

I appreciate authors spent so much effort on this study, but I didn't agree that GEDI is good biomass estimation for Olive orchard's in this way.

We sincerely appreciate the reviewer's recognition. We fully understand the limitations of the GEDI sensor for olive orchards. However, despite these constraints, we believe the study provides valuable exploratory insights. It contributes to understanding the feasibility and current challenges of applying GEDI data for biomass estimation in cultivated and low-stature ecosystems, while highlighting areas for methodological improvement and future research.