Dear Authors

In the revised manuscript *"Predicting the thickness of shallow landslides in Switzerland using machine learning"*, you present/developed a model that enhances existing landslide thickness prediction methods. You test three machine learning (ML) techniques. The ML approach is based on two landslide inventories and leverages various environmental covariates to achieve improved predictions.
Landslide thickness is a critical parameter for landslide susceptibility modelling and hazard indication mapping, making it highly relevant for researchers and practitioners in natural hazard management. This study will certainly interest the readership of *NHESS*.

The revised manuscript is significantly clearer than the original first version of the manuscript. I recommend minor revisions, which are listed below. My review is based on your version with tracked changes, so please refer to that document for line numbers.

General comments

- You often use nested sentences and include examples in parentheses. I recommend simplifying these passages and adopting more paratactic (shorter, simpler) sentences to enhance clarity. If an example is essential, incorporate it directly into the text to improve fluency.
- Regarding the graphs, I found many of them difficult to read due to e.g. small font size, tiny dots (e.g., Fig. 6), or white text on light grey backgrounds. I suggest reviewing these graphs and making adjustments to improve their clarity and readability.
- You frequently refer to R-package names throughout the manuscript. Please ensure consistency in how you format them. I suggest using italics for package names.
- There is inconsistency in how you refer to figures and table – for example, sometimes you use "Figure/Table," and other times "Fig." and "Tab." Please standardise this across the manuscript. Additionally, I recommend omitting the word *see* before referring to figures or tables. Instead of writing sentences like "In Figure 5, you see a XY-plot," I suggest directly presenting your results and referring to the figure in parentheses, e.g., (Fig. 5). This approach would improve readability.

Specific comments

<u>Abstract</u>

L1: Throughout the manuscript, you often refer to variables as parameters, which is understandable. However, I recommend avoiding the term *parameter*, especially when discussing statistical methods due to its specific statistical connotation.

L3: I suggest introducing the abbreviation "RF" for random forest when it first appears in the text and consistently using it afterwards.

L4: For "existing models," could you briefly specify which ones you refer to (simple-Z…)?

<u>Introduction</u>

L14: Rainfall-induced spontaneous landslides.

L15: Remove the word *such* for simplicity.

L16ff: Consider shortening the detailed descriptions and numbers related to damages; they may not be essential here.

L34: Rewrite as a new sentence: *However, in some cases, the shear horizon is located within the top three meters.*

L38: … is measured perpendicular to the original slope surface down to the failure plane.

L67: The pure engineering perspective on soils somewhat contradicts the soil horizons described below.

L94: Figure caption: Variations in shading reflect differences in soil properties.

L95: parameter (see my comment above).

L101: … modelling approaches have been adopted: (i) conceptual models, (ii) empirical models, and (iii) physically based models. -> Maintain this order in the subsequent descriptions (you changed it somehow right now).

L118: Start the sentence with *The accuracy of the…*

L123ff: I recommend numbering the objectives for better clarity and structure.

Study area

First paragraph: Please refer to Fig. 2.

Materials

L147: …different Swiss landslide inventories…

L162: So you estimated the thickness value of 435 records (which is your target to predict afterwards….). It is probably a bit misleading.

L165: You wrote in L150 that you already removed these landslides with a value larger than 2m.

L185: This is one of these sentences where you write what is seen in Figure 2 and Table 2 (please see my comment above).

Table 2: …. HMDB and KTBE shallow landslides datasets.

Figure 2: It would be helpful to include the boundary lines between the Jura, Central Plateau, and the Alps.
Minor comment: In the first sentence describing the study area, you mention that it encompasses large parts of Switzerland. However, based on the map, this doesn't appear to be the case.

L198ff: Please maintain consistency in your bullet points, using either complete sentences or concise phrases throughout.

Methods

L312: The last sentence seems more suited to the discussion section.

L386: Please remove the sentence, as the following description is repetitive.

Results

In the first section, the descriptions of the figures and tables tend to shift back and forth. I recommend restructuring this section to improve the flow and clarity.

L412: I suggest avoiding the term *trend* since no statistical trend was tested. Instead, consider using *tendency*. You also use the word *trend* later in the text, though I did not mark those parts.

L418: With *visual*, you refer to a verification based on orthoimages/maps?

L407: Is there a peak at 1m in the HMBD, or could the bin size influence it? How did you determine the bin size choice?

Table 5: (i) The MAD is missing, despite being described in the text. It would be helpful to place the related key figures next to each other (e.g., mean and standard deviation; median and MAD) for better clarity. (ii) Landslide thickness (HMDB: n=709) and slope (HMBD: n=648). Could you explain where these discrepancies in the HMBD and sample size come from? (iii) For the covariates, please refer to SwissAlti3D, as the values are derived from there, correct? (iv) Also, for clarity: elevation *[m a.s.l.]*.

Figure 5: I don't see a clear trend with the KtBe slope from the dataset, as the medians are approximately the same between 30° and 40°.

L439: You mention the existing models (also in other parts of the manuscript). It might be clearer to refer to them as *'models in comparison'* to distinguish them more explicitly.

Table 6: You could add a line between your ML models and the models in comparison and hence, split the table.

L439ff: As I mentioned in my first review, the data is, from my point of view, not distributed along the 1:1 line.

Figure 5: Please increase the dot size. Instead of *landslide thickness actual*, I suggest writing *measured landslide thickness* and *predicted landslide thickness*.

Discussion

The newly introduced Chapter 6.4 seems weak from my perspective. The entire paragraph does not reference other publications. Additionally, statistical methods have strengths and weaknesses, which could/should be addressed as well.