

## Authors response:

### Suggestions for revision or reasons for rejection (Referee 1)

(visible to the public if the article is accepted and published)

The authors' answers to most of my questions and the corresponding changes in the manuscript are acceptable. However, there are a few items that I felt more explanations or changes are needed.

Dear Referee 1,

we would like to extend our gratitude for the efforts you put into reviewing our manuscript. Your detailed feedback and suggestions have been instrumental in refining our work. We are pleased to inform you that we have successfully integrated all of the recommended changes, which are briefly summarized below:

1. The added content is not enough to justify the use of ERA5 in this study. As pointed out by both reviewers, the resolution of the ERA5 product is too low given the size of the study area. Therefore, the most convincing reasons to use ERA5 could be either one or both of these

- a) the soil moisture variability within the study area is negligible and
- b) there are no other data sources applicable.

The authors mentioned the first reason in the response to the other reviewer but not in the revised paper. I believe it's important to add that in the manuscript to clarify any potential concerns of future readers.

We agree, that providing more information why choosing ERA5-Land over other datasets improves the rationale of this work. Therefore, we have added a paragraph in section 2.2.4 (L165-174), addressing both arguments (a&b).

2. The paragraph under Section 3.3. I appreciate the modifications the authors made. However, I insist on my previous point that this section should not be there unless a stronger connection to the results is presented. Since the goal of this paper is building models instead of purely doing some field measurements, the discussion about those measurements should be in the Data section. Unless the content discusses the impact of those measurements on the modeling results. Right now, the section is just about those measurements. Another way to work this around is to break this paragraph down and put those sentences near the more relevant discussions about results in the sub-sections that follow.

Thanks for your feedback. We endeavored to streamline the manuscript by: 1. Relocating one sub-paragraph (previously labeled as 3.3.1) to the Appendix and transferring the description regarding RD to the Material and Methods section. Consequently, the new Section 3.3 now encompasses "Comparisons of RD with SWC<sub>CORE</sub> and SWC<sub>PRED</sub>". As the revised title suggests, a primary focus of our research centers on predicting RD through spatiotemporal modeling, with the potential to support day-to-day forestry operations and foster sustainable forest management.

3. It's fine if the authors insist on keeping the evaluation involving both the RD and the SWC, but more effort will then be needed to differentiate those two evaluations, as one is an apple-to-apple comparison, whereas the other one is not.

I would say keeping the existing evaluation between the predicted SWC and RD is probably fine, as the goal for this is to demonstrate the usefulness of the predictions. However, I will definitely expect more quantitative comparisons between the predicted SWC and SWC measurements, as this one tells us how good your model is and it is the main objective of this work.

Therefore, I suggest considering adding a few more other metrics, such as RMSE and NSE, to the latter for a more comprehensive evaluation.

We calculated and added the mentioned evaluation metrics and show them in Figure 5.

Once again, we sincerely appreciate your time and expertise in evaluating our manuscript.

Kind regards,  
Marian Schönauer, on behalf of the authors

## Authors response:

### Suggestions for revision or reasons for rejection (Referee 2)

(visible to the public if the article is accepted and published)

I have reviewed the manuscript by Schönauer et al. for the second time, and I am honored that so many of my comments were considered useful by the authors and further implemented in the manuscript. I consider the paper much better now. Compared to the previous version, the updated manuscript:

- Is easier to follow (e.g., changing from “Trials 1 and 2” to “Trials Wet and Dry”)
- Addressed and explained many methodological concerns (e.g., locations of measurements in Sites A and B)
- improved the discussion of the results (e.g., why was DTW025 an important predicting variable?)
- is more honest regarding the study limitations (e.g., spatial covariation detection).

Dear Referee 2,

We would like to extend our gratitude for the efforts you put into reviewing our manuscript. Your detailed feedback and suggestions have been instrumental in refining our work. We are pleased to inform you that we have successfully integrated nearly all of the recommended changes, which are briefly summarized below:

However, I still have some minor (mainly technical) concerns:

**The following changes were integrated as is.**

L34: and has shown to be -> and has been shown to be

L100: during this field trials -> during these field trials

Caption Figure 2: dryer -> drier

L120: dezember -> december

L206: dryer -> drier

L206: "subsequent section 2 of the same machine trail (...) (Figure 2, Site A), or in close proximity of section 1 (Site B)" – isn't it the other way around (Site A and B) ? Based on Figure 2, it looks like in Site A it was in close proximity (i.e., roughly parallel), and in Site B, it continued on the same trail.

**Thanks for noticing, we changed the names accordingly.**

Figure 5: the legend indicates that the y-axis is SWC\_CORE, but the figure indicates the y-axis as SWC\_SR

**An artefact from an older version of the manuscript, which now has been updated.**

Figure 7: why is the asterisk in parenthesis sometimes [0.28(\*)], and other times not [0.34\*] ?

Captions of several figures: “Significance levels are indicated by \*\*\* for  $p < 0.001$ , \*\* for

$0.001-0.01$ , \* for  $0.01-0.05$ , (\*) for  $0.05-0.10$ , and 'ns' for  $p > 0.10$ ” – asterisk in parenthesis for  $0.05-0.10$ , but not for the other ranges.

**The asterisks in parenthesis “(\*)” is indicating a, lets say trend, with an p-value between 0.05 and 0.10. “\*\*” indicates significance (threshold of 0.05), with p-value of 0.01-0.05.**

L294: too fragile ?

**Initially we wanted to say „seem to be fragile“, but now removed the „to“ so it matches the meaning again.**

In Appendix B, in one of the plots, Kendall’s coefficient is NANA?

**There were not enough values to calculate tau, we replaced the NANA, given by the created function through a ‘-’.**

L177-178: "the main outputs when both datasets were combined can be seen in Appendix A"  
-> this is a result, and I think it would be more appropriate to mention this in the results section.

We agree, the sentence of regard has been shifted to the results.

L305: particle-to-particle

Changed as recommended.

"Section 4.4.1 Temporal variation was higher than spatial variation": can you really claim that? Have you quantified temporal and spatial variation, in order to be able to state that one is "higher" than the other? In the text, it is clearer that you mean that the temporal variation was more important than the spatial variation.

Absolutely, the subheading has been changed accordingly.

L364: the sentence is started with "this indicates". What is "this" referring to in this context? Please consider re-phrasing it. For instance, the sentence could be: "The temporal variability in soil moisture between the trials was more important in this study than the spatial variability within the relatively small areas where each trial was conducted".

'This' was related to the previous paragraph, but we agree, it is better to readdress the topic again (Line 366).

L367: Sita A -> Site A

Changed as recommended.

L374: wether?

Changed to ,either‘

L371-372: Please re-phrase this sentence in a more formal way: "Therefore, we have to admit, that the study design was not ideal for assessing the ability to predict rutting with a spatiotemporal model of SWC, and the results have to be considered with caution." – remove the part about "we have to admit", maybe add something on the lines of "limitations" of this study.

We would like to stick to this rather personal comment, as it was really a mistake by us (or due to resource-limitations).

Once again, we sincerely appreciate your time and expertise in evaluating our manuscript.

Kind regards,  
Marian Schönauer, on behalf of the authors