

***Interactive comment on* “Field observations of soil hydrological flow path evolution over 10 Millennia” by Anne Hartmann et al.**

Anonymous Referee #1

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General Comments In this paper, the authors investigated changes in soil characteristics and water flow through time by examining a chronosequence of soils from a retreating glacier. The study is very thorough, detailed, and makes conclusions that I think are novel and interesting to the community. The paper is mostly very well written and structured, but I have a few areas of concern and/or need for clarification, detailed below.

Specific Comments Issue 1: Hypotheses. I think the hypotheses in lines 9-13 on page 3 could be improved or re-stated as research questions. In general, I think they are a bit vague for hypotheses. For example in (1), what does “change” mean?, in (2) what does “more important” mean? And (3) what process is hypothesized to lead to a reduction in particle size and/or increase in porosity and/or increase in subsurface

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water storage? And for (3) should this be more than one question? It hits a few different predictions/questions.

I think the wording used when addressing the hypotheses in the conclusion is also a bit strong. I think there's an argument to be made that it is okay to say "confirmed" about a hypothesis, just being careful to avoid "proved" but it gave me pause. I think the conclusion could benefit from a few statements identifying the uncertainty in the set up and analysis and then caching the "confirmation" of the hypotheses in those terms.

Issue 2: Description of the study design. I had to read through the methods several times, taking notes and adding up samples from "plots" and "subplots" trying to be sure I understood where the data was coming from. I think the section would benefit from a paragraph in 2.2 that makes very clear: how many plots are there in each moraine? How far away are they from each other? (can this also be shown in Figure 1?) are there subplots in every plot or just the dye application plots? I realize this information is all included in the paper, but it's scattered throughout the methods so some piecing together was required for me to figure it out.

Issue 3: Heterogeneity. I think it'd be good to have more discussion about the heterogeneity in these moraines, then how that heterogeneity was addressed in the study design and how it affects the interpretation of the results. Would you expect these moraines to be pretty homogeneous? If not, how were the heterogeneities accounted for, and how likely is it that the results might be different if the sites were placed differently?

Issue 4: Discussion structure. This discussion does a good job of putting the findings of the paper in context with previous work, but could you also add some information about how these changes are happening? Having processes tied to the changes would be really helpful for applying the findings here to other places. There is a bit of discussion about this with regards to vegetation and flowpaths, but not so much with the texture and structure.

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Additionally, in the first part of the discussion findings are sort of point-by-point related to previous literature. I wonder if the readability of the section might be improved by restructuring a bit to talk about how some of the changes in texture and structure happen together rather than breaking them all into separate paragraphs. There are a lot of findings here, and I realize that makes it kind of hard to present them concisely, so it's just a suggestion. But maybe similar processes are leading to the changes observed, and discussing those processes and the results may help.

Technical Corrections Page 6 Line 15 parameter should be plural

Page 6 Line 24 should “amount” be “number”?

Page 7 Line 6 I think the comma after “both” can be removed

Page 7 Lines 22 and 29 can you add a note explaining what you mean by disturbed and undisturbed? I assume the structure was preserved in the undisturbed sample. . . but they were both removed from the site, so they were definitely disturbed!

Page 16 Line 14 maybe “agree” would be better than “correspond”?

Page 18 Line 17 add “age” after “increasing moraine”

Page 18 Line 17 what is unstable flow?

Page 18 Line 27 maybe use a different word than “significantly” since it isn't a statistical comparison

Page 18 Line 27 see = saw

Page 20 Line 12 remove “also”

Page 20 Line 33 remove “already”

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