

## ***Interactive comment on “Frozen debris lobe morphology and movement: an overview of eight dynamic features, southern Brooks Range, Alaska” by M. M. Darrow et al.***

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Response to Reviewer 2 for manuscript TC-2016-1, “Frozen debris lobe morphology and movement: an overview of eight dynamic features, southern Brooks Range, Alaska”

We thank Reviewer 2 for the thorough review of our paper. It has been difficult to structure this paper in a way that makes sense, and many of the reviewer’s comments will help to address this issue. In the text below, your initial comment is presented followed by the authors’ response.

1. Writing style: The paper is long and wordy, the style reminds me of an oral lecture

C1

(much “we have...” etc.), including many details which are important in a report to e.g. a government agency, but not in a comprehensive scientific publication. The paper contains some redundant information, like “rain has exposed ice” is mentioned some times. The paper could be re-structured and shortened. This specific comment contradicts Reviewer 1’s initial comment “The text is well written and has a logical structure.” In last two decades, the lead author has been a push in the professional geotechnical community to use the active voice, rather than the passive voice which is traditional and “what we all learned”. This leads to ‘we haves’, where appropriate. Can the reviewer please indicate which details are superfluous to a scientific publication? A check of the document indicated that the “rainfall” reference occurred twice; the second reference was deleted.

2. Introduction: is very long, ranging from an historic overview about the research development of the slope features to a mini review about the term “rock glacier”. I would suggest shortening this and stick to scientific important points. Originally, the Introduction was shorter. The editor who initially reviewed the article instructed the authors to provide a greater literature review. At this point, the literature review of rock glaciers has been moved to the Discussion section.

3. Setting: A “Setting” chapter is missing as far as I can see. You use the “Introduction” partly to describe the setting, however, I think readers not familiar with the region would like to know a bit more about the geophysiological conditions including key values of earlier investigations as given in p.4, l. 4 ff. Added a Study Site and Background section, providing some general information about the AOI, and moving the discussion of previous FDL work to this section.

4. Methods: 2.1. is very wordy and could be shortened. In the results/discussion you introduce new methods, like dating organic layers (p. 13) or the collection of creek samples (p. 9) etc. This should be introduced in the method section, and subsequently described in the result chapter. An attempt was made to shorten the method descriptions. Moved referenced text into the Methods section (as indicated below).

C2

5. Results: The results chapter is much longer than the Discussion chapter, often because you already give interpretations of observations here, which would be good for a discussion. As mentioned above, also new methods are introduced here. Methods have been moved as suggested; the text was revised with this comment in mind. Also, a large portion of the text describing the destabilization process has been moved to the Discussion.

6. Discussion: The discussion is poor. It contains paragraphs which would be good in a "Setting" chapter which includes previous investigations (e.g. p. 12) or results (p. 13, organic layer), but is lacking a scientific discussion such as a comparison and relevance to other studies, rock glaciers etc. This is also pointed out by reviewer 1, and highlighted nicely in that review. Maybe it is better to move your little rock glacier review from the Introduction to a discussion chapter, and really discuss your finding with the literature focusing on debris bodies containing more coarse material. Moved relevant parts of organic dating discussion to methods and results. Moved rock glacier review into this section, comparing and contrasting to FDLs. The rest of the Discussion has been heavily revised.

7. Your timing based on the one radio-carbon date. You must be very careful here, normally I would say that you cannot say anything based on one dating from one site. You can mention the date, but one dating does not justify a strong conclusion. But it is good to discuss against other studies, as suggested by reviewer 1. We acknowledge the reviewer's concern of one radiocarbon date; however, we do feel that it is useful preliminary information regarding the formation/movement of these features. This text has been significantly revised, including acknowledgment of having only one date.

8. Conclusions: The bullet point conclusions sound ok and are mostly justified by your observations and measurements (beside the dating). The second part is again a Discussion and not a conclusion, so you should remove it or move it to an appropriate place in the Discussion. Indicated text has been moved as suggested.

### C3

#### Specific comments:

p. 3, l. 21: You may use the term "moraine-derived". This text has been rewritten.

L 27 ff: This is all a discussion. The referenced text has been moved and integrated into the Discussion section.

p. 4, 2nd para: This is typical information for a Setting chapter. The referenced text has been moved to a new Study Site and Background section.

p. 5, l 1: This whole paragraph can be removed. Deleted the referenced text.

p. 7, l 16-19: Remove Deleted as suggested.

p. 8, l 21: This is interpretation and should be addressed in discussion. This is a difficult comment to address. While the referenced text does contain some interpretation, it is part of a summary of the field observations (results of the field work). If the referenced text were pulled out to move to the Discussion section, it would necessitate additional text to explain its relevance there, making the paper longer.

L 30: agreeing with reviewer 1 – also what commonly is termed rock glaciers are of course frozen and moving debris lobes, only consisting of coarser material. And maybe frozen debris lobe is actually a better term than rock glacier, which you should discuss in the end. Yes, the term FDL could be broader to include rock glaciers; however, we want to stress that these features we are describing in the Brooks Range are fundamentally different in size, composition, vegetation coverage, and mechanisms of movement than what is now called a rock glacier. We agree that the discussion should occur, but are concerned about increasing the paper length even more.

p. 9, 2nd para: Again, a lot of interpretations of the observations which sound reasonable, but should come into a discussion. Most of this paragraph is observations, with little interpretation; deleted the phrase about rainfall helping to melt ice.

l. 20: This is a figure text, avoid explain in figures in detail in the main text. Revised

### C4

to “The exposed massive ice corresponds with an open surface crack, with a buried organic layer vertically offset to its right and left, indicating downslope movement.” This does not repeat the figure caption.

3rd para: refers to 3rd paragraph? Says not mentioned in method chapter. We are a little unclear as to what the reviewer is referencing. With certain assumptions in mind, we revised the text to: “Figure 4b is a presentation of the isotope analysis results with the GMWL and isotope values from massive ice bodies taken from the literature, including Pleistocene wedge ice. . .” We introduced the GMWL in the Methods section.

p. 10: Here you mix observation and velocity measurements, which you present in subsequent paragraphs, it is a bit hard to follow this structure. Moved a large portion of this text to the Discussion section.

p. 11, l. 13: – Remove this sentence, if the thing would not move downhill, I would question your measurements. The point of this sentence was to indicate that the FDL demonstrates minimal spreading from the centerline. It has been revised to: “Movement is generally parallel to each FDL’s longitudinal profile.”

l. 27: Again parts of the paragraph describe a method you used. The referenced text was revised, with portions moved to the Methods section.

p. 13, l 1: you mention now “benches” what is this? Maybe explain this is a setting part. In the following you again introduce a new method (dating see above). Moved the organic soil sampling and methodology to the Methods section. Moved the result into the Results section. Kept part within the Discussion related to timing.

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