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The Cryosphere Discussions

Interactive comment on "Subglacial drainage patterns of Devon Island, Canada: Detailed comparison of river and tunnel valleys" *by* Anna Grau Galofre et al.

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The study of Grau Galofre et al. is an attempt to provide quantitative data for distinguishing the traces of former subglacial conduits in the glacial geomorphological record. There have been few such studies in the past and it is thus a commendable effort. The study is technically well-executed but it largely ignores relevant available literature, to its own detriment. A major issue, already raised by Stephen Livingstone (Reviewer 1) is an erroneous use of the term 'tunnel valley' while the landforms in question would be described by most as meltwater channels. Treating the studied landforms as tunnel valleys, and referring almost solely to literature on tunnel valleys (which are fea-

tures of much larger size as S. Livingstone points out), the authors put all the weight on distinguishing between their 'tunnel valleys' – but meaning subglacial meltwater channels – and fluvial channels. However this is a simplistic approach. When attempting to better reconstruct and understand the characteristics of the former drainage systems of glaciers and ice sheets, it is as important as distinguishing between subglacial meltwater and fluvial channels (i.e. traces of former subglacial drainage vs record of more recent fluvial drainage) to distinguish subglacial meltwater channels from submarginal and purely lateral meltwater channels (i.e. traces of subglacial drainage vs traces of supraglacial, englacial and ice-marginal drainage). Indeed, many of the analysed channels that display low undulation in their longitudinal profile and occur in series cut in the slope might have formed as submarginal or true lateral channels. There is an ample amount of literature on these: both older, largely descriptive studies (e.g., Mannerfelt, 1945; Mannerfelt, 1949; Sissons, 1958; Clapperton 1968) and newer attempts to classify and discuss glacial meltwater features (Greenwood et al., 2007, 2016). Of particular interest might be a study of Syverson and Mickelson (2009), with observations of modern-day meltwater channel formation, and a study by Art Dyke (1993) who used meltwater channels to reconstruct the character of glaciation and the pattern of deglaciation in the broader region of this submitted manuscript.

Submitting this review as a second reviewer and having read the review by Stephen Livingstone, I concur with all his comments.

ISSUES TO ADDRESS: The motivation for the study and its setting within the context of existing knowledge in the field is not articulated enough. The authors might attempt to spell out more clearly what the study brings that older studies were lacking – this is a point where to refer to the existing literature on glacial meltwater channels.

The methods section is lengthy and at places self-serving. Why is there a need to reproduce the surface topography at cm resolution? The authors might attempt to better align the methods used with the stated objectives.

The distinction between ‘tunnel valley erosional regime’ and ‘river valley erosional regime’ is vague. Ideally, the authors might qualify the main characteristics of subglacial and fluvial drainage (based on literature) and look for the characteristic features in their data. The manuscript is overly relying on Kehew et al. (2012).

Portions of the text that refer to the figures read very much like figure captions.

Broader, v-shaped cross profile of the river valleys vs. narrower, flat-bottom, steep-walled cross profile of the meltwater channels – could something be inferred about the discharge and the length of formation/operation of the feature(s)? While this goes beyond the scope of the manuscript, a few references could be provided where this topic might be followed.

MINOR COMMENTS:

P1 L8 ‘Kinematic mobile LiDAR’. I am not an expert on this instrumentation but from checking briefly online, either one or the other adjective is usually used. Pairing the two adjectives seems to make little sense to me since they mean largely the same, just one having a Greek root and the other a Latin one.

P2 L23 Younger Dryas

P2 L33 Criteria is plural, write criterion where it is a singular.

P2 L34 Warm-based is a more common term than wet-based

P3 L14-17 Ages in Dyke (1999) are in radiocarbon years, however, the notation ‘ka BP’ is now commonly used for calendar years. Either state that it is C-14 years or calibrate.

P3 L20 remove the full stop before the reference

P3 L34 ‘deposition landforms’ is a more common term

P5 L12-13 ‘Downstream of. . .’ I don’t understand what do you mean with this sentence.

P8 L24-25 Check the wording, ‘represent’ appears two times

P8 L32-33 ‘requires quantitative field longitudinal profile observations’ reword to ‘requires measuring longitudinal profiles in the field’.

P9 L24 agreement

P13 L3 replace ‘in panel (b)’ with ‘in Fig. 5b’

P13 L4 replace ‘packs’ with ‘accumulations’

P13 L13 ‘criteria exposed before’ – exposed does not work here very well, search for a more fitting verb (stated, listed).

P13 L31 shallow

P13 L33-34 This is something that should be discussed further with references to older literature.

P14 L8-10 ‘We argue here that differences among channel direction and local topographic gradients are also indicative of subglacial erosion in areas where the ice erosion rate by sliding is lower than the meltwater erosion rate (Weertman, 1972; Paterson, 1994).’ These can be submarginal meltwater channels that record the ice surface slope direction but do not necessarily bear any evidence with regard to ice erosion rate.

P15 L1-4 Here the fact that you have been ignoring all the types of meltwater channels other than subglacial really becomes problematic because you might be dealing with lateral or submarginal channels in this case.

15 L10-12 Again, there is a possibility that these might be submarginal or lateral meltwater channels. It might well be that most or all the channels that you classify as subglacial indeed are subglacial and not submarginal or lateral. But you need to be provide argumentation for this.

FIGURES: The figures are generally well-crafted.

Fig. 3 Add group numbers or panel letters so that the groups can be easily identified.

The figure would be more informative if one could see the topographic settings of the pictured groups of channels. Could the photographs possibly be draped on a DEM-derived hillshade?

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