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Interactive comment on "Union Glacier: a new exploration gateway for the West Antarctic Ice Sheet" *by* A. Rivera et al.

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This is a good paper, which includes a large amount of important baseline data concerning the glaciological state of Union Glacier, an important outlet glacier in the Ellsworth Mountains. On the basis that these data require an outlet, and may prove to be very useful in future, I recommend publication of the manuscript.

GENERAL COMMENTS

Whilst the hard-won data is important, I am a little concerned about the way it has been packaged in the manuscript. The abstract seems to have two themes, neither of which is really assessed in any significant depth within the body of the manuscript. The first theme, which is also strongly reflected in the title, is that Union Glacier is "a

new exploration gateway for the West Antarctic Ice Sheet". The second is that Union Glacier has a potential instability due to the configuration of its basal topography.

Whilst the first theme is of interest, because it is not referred to in any great detail elsewhere in the paper (except for the title and the opening sentence of the abstract) and because it does not have important implications for the scientific aims of this paper, I suggest that the prominence of this topic be reduced. The authors should reword the title, and rework the opening sentence of the abstract. How about something along the lines of: "We performed a comprehensive glaciological investigation of Union Glacier, a major outlet glacier within the Ellsworth Mountains. These data show XYZ, and are important because of ABC. . ..".

With regards to the second theme, whilst the subglacial topography does reach a minimum of 858 m below sea level, the authors own radargram (Fig. 7b), and the extensive surface crevassing (Figs. 2 & 7a) shows that 1-4 km up-ice of location 'F', a prominent bedrock ridge crosses the Union Glacier valley. This ridge reaches an elevation of ∼200 m below sea level, and would play a key role in modulating any potential future reverse slope instability. This feature needs to be acknowledged far more than it is currently. It would enable a prolonged stand-still of the grounding line under the scenario invoked by the authors, particularly since it is located at a pronounced narrowing of the valley.

I think the manuscript needs to be much more honest about what it does, i.e. presents a hard-worn and useful dataset that documents the present state of Union Glacier. This will produce a more effective paper that does not become side-tracked by the need to dress it up as either an assessment of a logistical hub, or an assessment of the vulnerability of UG to marine ice sheet instability.

The first reviewer, Ted Scambos, has already provided comprehensive recommendations to help improve the grammar and readability of the manuscript. I will not repeat this exercise, but do strongly encourage the authors to play close attention, and follow,

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his guidance to improve their manuscript. The manuscript will require some effort to condense and streamline the text significantly prior to it being suitable for publication.

SPECIFIC COMMENTS

Abstract: P1228. Line 5: It is the Institute Ice Stream, not the Institute Glacier.

P1228. Line 15: I am a little confused by the statement that the subglacial topography is much deeper than estimated before. The paper by Rivera et al., Annals of Glaciology, [2010] has a radargram (Fig. 3) and profile (Fig. 4) which shows the bed topography in the Union Glacier valley to be in the order of 800 m below sea level.

Introduction: P1228. Line 21: There are better references than Humbert [2010] to use in this context (e.g. any of the first 3 references in the paper by Humbert would be appropriate instead).

P1229. Line 17: What about Recovery Glacier? Moeller should be Möller.

P1229. Line 24: Is it the 'Horseshoe Glacier'?

P1230. Lines 1-3: If this is the main aim of the paper, then why isn't it more prominent in the paper's title and abstract?

Study area: P1230. Lines 5-19: Since the study area is Union Glacier, I would start with describing that rather than Patriot Hills/Horseshoe Valley. At present, I think it will confuse readers not familiar with the area. By all means include the previous studies of Patriot Hills, and why ALE moved, but the focus of this paper is Union Glacier, not Patriot Hills.

P1230. Line 24: 'merge' rather than 'join together'?

P1230. Lines 25-26: Do you mean 'medial moraine' rather than a central one? Methods:

P1234. Line 8: Do you mean "..to measure near surface snow and ice layering to a

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depth of 450 m. . .”?

P1234. Line 19: ‘tyre’ rather than ‘tire’?

P1234. Line 24-28: It appears that migration was not applied to the ice thickness data. Is that correct?

Results: P1239. Lines 4-9: I cannot see a “detailed internal stratigraphy” in the upper hundred metres, and I’d certainly be very wary of claims for Raymond Bumps in the area without the authors showing the evidence for these. I suggest this paragraph be re-worded or removed entirely.

P1240. Line 4: Do you mean ‘Three Sails’? You should also annotate this locality on Figure 1.

Discussion: P1241. Line 9: BEDMAP2 not BEMAP2. IceSat should be ICESat too (you should check this throughout the manuscript).

Conclusion: P1242. Lines 10-14: This statement isn’t entirely consistent with the closing sentence of the abstract. I suggest that you reword the abstract to bring it more in line with the message being put across in the conclusions, which is a fair statement of the likely impacts of GL/GZ retreat.

Figures: Is there any way in which the radargrams can be made clearer? At present they seem very dark (e.g. I can’t really make out what is going on in Fig 8-lower at all). An attempt to adjust the brightness/contrast on the images would help.

REFERENCES:

Humbert, A., (2012). Vulnerable ice in the Weddell Sea. Nature Geoscience, 5, 370-371.

Rivera, and 4 others, (2010). Glaciological investigations on Union Glacier. Annals of Glaciology, 51, 91-96.

Interactive comment on The Cryosphere Discuss., 8, 1227, 2014.