

## ***Interactive comment on “Glacier-like forms on Mars” by B. Hubbard et al.***

**B. Hubbard et al.**

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We thank Wilfried Haeberli and Sarah Springman for their insightful and helpful comments.

One of the aims of this paper was to bring issues such as these to the attention of the wider cryospheric sciences community, and we are encouraged by your comment. It is clear that more research is needed on GLFs in order to address issues such as their precise internal composition and their mass balance regime - as we call for in our concluding section. Such information would go some way to allowing alternative interpretations and sub-classifications to be presented and evaluated.

It is likely that what we and others refer to as 'GLFs' do in reality include a range of features extending from frozen mass flows to almost pure ice with a local mass-balance regime. However, we believe that many GLFs are not pure mass flows because they

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appear to (without formal morphometric analysis) lack a source area large enough to have supplied all of their mass (as argued by Hubbard et al., 2011). We explicitly accept this possibility and acknowledge it in our response to review comment C883 that landforms which we present as “similar in planform appearance to terrestrial valley glaciers” have previously been interpreted as ice assisted talus flow and rock glaciers. That said, the definition and differentiation between rock glaciers and glaciers, for example, on Earth is not always clear, even where direct field research has been carried out; we are certainly no closer to differentiating between such forms on Mars.

Finally, we note that in their criteria for recognition of glacier-like forms Souness et al. (2012) specified no compositional requirement, thereby not discounting alternate compositional forms under the umbrella of GLFs. Perhaps, this is ready for refinement.

References: Hubbard, B., Milliken, R. E., Kargel, J. S., Limaye, A. and Souness, C. (2011) Geomorphological characterisation and interpretation of a mid-latitude glacier-like form: Hellas Planitia, Mars. *Icarus*, 211, 330-346, doi:10.1016/j.icarus.2010.10.021.

Souness, C., Hubbard, B., Milliken, R. E. and Quincy, D. (2012) An inventory and population-scale analysis of martian glacier-like forms. *Icarus*, 217, 243-255, doi:10.1016/j.icarus.2011.10.020.

Kind Regards,

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Interactive comment on The Cryosphere Discuss., 8, 2957, 2014.