

Interactive comment on “Glacier ice in rock glaciers: a case study in the Vanoise Massif, Northern French Alps” by S. Monnier et al.

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1. Does the paper address relevant scientific questions within the scope of TC? - yes
2. Does the paper present novel concepts, ideas, tools, or data? - yes
3. Are substantial conclusions reached? yes
4. Are the scientific methods and assumptions valid and clearly outlined? yes
5. Are the results sufficient to support the interpretations and conclusions? yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? yes
7. Do the authors give proper credit to related work and clearly indicate their own

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new/original contribution? See below

8. Does the title clearly reflect the contents of the paper? - yes

9. Does the abstract provide a concise and complete summary? - yes

10. Is the overall presentation well structured and clear? - yes

11. Is the language fluent and precise? - no (see below)

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? - yes

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? - no

14. Are the number and quality of references appropriate? Number is o.k. figures are too small (see below)

15. Is the amount and quality of supplementary material appropriate? - yes

The authors studied a relatively small active rock glacier in the northern French Alps by using ground penetrating radar and photogrammetric velocity measurements. After describing the location and providing a morphological description of the rock glacier, the methods used in this study are well described and the results of the investigations are presented and discussed in the next chapter.

The text is well organized, although the English of the text needs some revision as the text is partly hard to understand. I recommend that the authors ask a native English speaker to revise the English.

From the data, particularly the georadar measurements, the authors conclude that the rock glacier contains a massive ice core in its upper part which displays numerous trough-shaped reflectors. These reflectors are interpreted as debris-rich thrust (shear) planes within the massive ice core. Due to the measured wave velocities and shape of

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the numerous reflectors this interpretation sounds conclusive.

But what does the basal boundary reflector indicate? Is this the bedrock surface or unfrozen, fine-grained sediment containing high amounts of water?

This paper is an important contribution providing clear evidence that this rock glacier is derived from a glacier. The existence of glacier-derived rock glaciers has been intensively discussed during the past. In recent years several examples have been published which demonstrate that this type of rock glacier occurs, although it is quite rare.

Figures 1, 2, 3, 8 and 9 are too small, e.g. on Figs. 8 and 9 the text is unreadable.

Further Comments

Page 3598,

Line 5: explain (spell out) CMP (common midpoint), better: The GPR survey included two CMP (common midpoint) measurements. . .

Line 8: data were processed. . .

Line 14: are you sure that the massive ice core is embedded in diamicton and not underlain by diamicton (lodgement till)?

Line 22: when active – displays annual velocities of a few cm to a few m due to internal deformation

Page 3599

Line 4: from natural exposures, from drillings and from geophysical methods (e.g. Hausmann et al. 2007, Krainer et al. 2010)

Line 19: what means epistemological challenge???

Line 21: between glacial and periglacial environments

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Heading, line 10: Location and morphology

Line 14: what is a glacial heritage??

Line 16: at the weather station??

Line 18: ... and by using. ...

Line 21: what is a pristine and bulged appearance??

Line 21: what are archetypal ridge- and furrow surface features??

Line 22/23: The blocks on the surface are composed of quartzite and limestone (or do you mean metamorphic limestone = marble?? quartzite is metamorphic quartzose sandstone)

Line 24: Is the upper part identical with the rooting zone??

Page 3601

Line 1 and 2: I do not understand this sentence

Line 5: and is bounded downward by

Line 7: do you mean transverse ridges?

Line 11: transverse ridges??

Line 13: the front appears as a more than 40 m high, continuous and steep slope

Line 18: what do you mean of material size? The grain size of the surface layer??

Lines 27 – 29: unclear

Page 3602

Line 1: since snow completely fills

Line 3: measurements of springs ... yielded values close to

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Line 7: what are late lying snow banks??

Page 3604

Line 5: what are late winter conditions. . .

Line 9: profiles were measured in longitudinal. . .

Line 10: Distance between transmitter and receiver was 2 m, spatial sample interval was 50 cm

Page 3606

Line 5: TWT – spell out

Line 12: The older one

Page 3607

Line 5: it is considered to be not older than a few thousands of years

Line 8: significant horizontal displacements

Line 13 - 16 unclear

Page 3608

Line 18, heading: do you mean integrated interpretation??

Line 20: An optimal interpretation??

Line 4: what is a dipping syncline structure, to where does it dip?? A syncline indicates deformation by compression, is this the case??

Line 20: Krainer et al described similar reflectors from an active rock glacier with a massive ice core from the Dolomites (northern Italy)

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Line 4: or even zero ice content

Line 8: temperature within the first meter

Line 17: where the thickness of the top (you mean surface) debris layer decreases and...

Line 27: along the rock glacier base

Page 3612

Line 17/18: Do you mean that the ice core of the rock glacier is underlain by fine-grained, water-saturated sediment (eventually a lodgement till)??

Line 22: what means morphologically decayed??

Line 23: The three stages of development

Page 3613

Line 3: and preserved under permafrost conditions

Line 6: what is a ruiniform appearance??

Line 7 to 16: unclear

Page 3614

Line 2: significant horizontal surface displacements

Line 10: instead of thrust planes better shear planes

Fig. 2: these are aerial photographs!!

Fig. 4: Natural exposure of massive ice overlain by approximately 1 m thick debris layer (active layer). Where is the backpack??

Interactive comment on The Cryosphere Discuss., 5, 3597, 2011.

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