

Interactive comment on “Dye tracing for investigating flow and transport properties of hydrocarbon-polluted Rabots glaciär, Kebnekaise, Sweden” by C. C. Clason et al.

Anonymous Referee #1

Received and published: 9 January 2015

General comments:

The authors present an interesting case study about the hydrological dynamics of Rabots glacier in Sweden. An aircraft crash produced hydrocarbon pollution at a part of the glacier, was the starting point for the investigation of the internal flow system of the glacier. Numerous dye tracer experiments at different injection points on then glacier were carried out in order to better understand potential contamination of the glacier and downstream ecosystems. The data nicely shows, the activation of the flow system of this glacier during the ablation period in summer 2013. The focus of the study is in the scope of HESS. The story of the paper is an asset. However, the analy-

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sis of the collected data and the presentation of the results is very poor and there gain of new knowledge concerning the hydrological dynamics of glacier system in general. There are a lot of speculations with respect to the characterization of the internal flow dynamics of Rabots glacier. Therefore I recommend very major revisions of the presented manuscript prior to a publication in HESS including an extensive revision of the i) presentation of the data (quality of the presented figures), ii) structure of the results section presented manuscript, and iii) interpretation of the collected data.

Specific comments:

In general, I liked the structure of the introduction section and the methods section. However, I have a few major concerns about the manuscript:

In general, I think the proglacial dynamics are not relevant for this study. You should focus on the experiments on the glacier. The tracer injections in the proglacial stream are, from my point of view, just valuable for calculating the rating curve. Another concern is, that you use the same tracer (of course earlier on the experiment days) for this purpose. But how can you be sure that there is still tracer in the proglacial stream system influencing your dye experiment on the glacier? The same holds for your differing injection points on the glacier. A multiple tracer-multiple injection points design at differing times throughout the ablation period would have been more straight forward.

Why were the injections points in the lower parts of the glacier and not in the source zone of pollution? You mentioned one sentence at the end of the manuscript. But this explanation is very important and should be provided in the methods section.

The quality of the figures must improve significantly! Figures 1 and 2 could be combined. Figure 3 does not cover the whole study period. Furthermore, the experiment days could be highlighted here and you could think about including here the turbidity information too. Figure 5 is the key graphic of this study. I could barely read the axis titles and the legends. Why is there no dye recovery curve for the first three experiments (according to Table 1 there was some tracer return)? Please mention in the caption

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that scaling of the y-axis is varying among the plots. Why did you show the regression lines with such a weak R^2 in Figure 7? You talk about differing regime types, highlight them. Figure 8 is used as kind of a perceptual graphic for characterizing the main flow units of the glacier. However, it seems that this information is from another study (Jennings et al., 2014). So please include your additional findings about the flow system in this figure, otherwise it is useless.

There are lots of speculations (e.g. Page 13721, Lines 18ff) throughout the paper. The discussion about the turbidity dynamics in the context of the relevant literature is vague due to the limited dataset. Furthermore, I think the definition of the four meltwater flow regimes is a bit vague and the identification of an increasing drainage efficiency during the melting season is nothing new. Using actual dates and DOY in parentheses would be better for more clarity at some points (e.g. Page 13716, Line 23).

The authors try to explain the results of the experiments in separate sections. From my point of view, it would improve the paper to discuss the findings combined with a focus on the internal flow system of the glacier.

Technical corrections:

Page 13712, Line 1: I would suggest including the specification (kerosene) of the pollutant for more clarity.

Page 13713, Line 12: Year of used reference is wrong. According to the references list it should be 2010. Please check.

Page 13715, Lines 8-11: This sentence would better fit into the conclusions section.

Page 13716, Line 8: Methods instead of Method

Page 13717, Line 1: rating

Page 13717, Line 3: include here the information, that you did this for varying water levels in order to get the rating curve.

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Page 13717, Line 4: Better title would be "3.3 Dye tracing experiments"

Page 13717, Line 6: 17 experiment? From Table 1, I just can see 15.

Page 13717, Line 17: What is this residence times?

Page 13722, Line 9: Please mention the rainfall event at this point too.

Page, 13722, lines 25 and 26: The term return curves here is misleading. Break-through curve may be more appropriate.

Page 13723, Line 5: Why is this breakthrough curve not shown?

Page 13723, Line 28: ...of dye injection instead of for experiments.

Page 13724, Line 2: for instead of of

Page 13725, Line 22: found instead of find

Page 13727, Line 5: I did not see this 60% reduction in Table 2. The values there are ranging between 5 and 71%

Page 13727, Line 22: efficient

Better quality of the mathematical equations (e.g. Page 13719, Eq. 3 and Eq. 5)

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13711, 2014.

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