

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-103

Karl W. Birkland (Referee)

Referee comment on "Brief communication: Weak control of snow avalanche deposit volumes by avalanche path morphology" by Hippolyte Kern et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-103-RC2>, 2021

This brief communication investigates the relationships between morphological characteristics and snow avalanche deposit volumes from 77 avalanche paths over about 15 years in the French Alps. The paper concludes that the relationships explored are statistically significant but relatively weak, and the authors present some ideas for why that might be the case. The paper addresses an important topic. I feel that the paper should be published, but I believe some revisions are necessary. In addition to my comments below, I've also included a PDF of the manuscript with suggested comments and changes included on that PDF.

A first comment is in that the title of the article (and in many other places) the authors talk about the "paths morphological characteristics". Since this is possessive, I believe they meant to write "paths' morphological characteristics". I think an even better way to write this would be "the morphological characteristics of the avalanche paths" or "avalanche path morphology". So, the title could be "Weak control of snow avalanche deposit volumes by avalanche path morphology". I think an even better title would simply be "The relationship between snow avalanche deposit volumes and avalanche path morphology", but the authors can decide on what they like the best.

Second, the authors do not specify if whether avalanche mitigation with explosives takes place in any of these avalanche paths. Are all the avalanches in the dataset natural releases? Or are they all explosive triggered? Or is there some mix? This is an important distinction that would definitely affect the results, and that needs to be clearly stated early in the manuscript. It would also be important to note if any avalanche paths have other defense structures, like catching dams, that might affect deposit volumes.

Third, and most importantly, I feel that the Discussion section needs additional work before this paper is publishable. I believe the authors should better explain their results and cite references where appropriate. For example, the first paragraph of the discussion just lists the results without any discussion at all. So, in the first paragraph they should

explain why it makes sense that they found relationships between path mean elevation and mean deposit volumes, and path surface area and mean deposit elevation. It seems to me that a simple explanation is that higher elevations typically receive more snow, so might be more likely to produce larger volumes, and that larger surface areas provide more snow to avalanche, which would also produce larger volumes. This is just one example, but in the attached PDF I have tried to provide other possible explanations and I have also urged the authors to think more about their results and how they might be able to better discuss and explain them.

Also, in the discussion there are some inconsistencies. Most of them are pointed out in the attached PDF, but I will highlight one here. On line 237 the authors state that "avalanche deposit volumes do not seem that much affected by avalanche path size", but on line 210 it says that one of the best simple relationships exists between avalanche deposit volumes and avalanche path surface area. Which of these two statements is correct?

Finally the primary finding of this work is that avalanche deposit volumes are only weakly related to the avalanche path morphology, but there is not a thorough discussion of the different complicating factors that may be affecting avalanche deposit volumes but which are not covered by this study. I can think of one such factor: The presence or absence of a big area of wind fetch to the windward direction of the avalanche path. Having good fetch would allow for more wind-blown snow to be deposited in an avalanche path and would therefore increase avalanche deposit volumes. I would imagine the authors could think of many other complicating factors that affect avalanche deposit volumes, and that likely reduced the strength of the relationships between path morphology and deposit volumes. It would be good to list and discuss these.

There are several minor corrections and typographical errors. I have tried to capture those in the attached PDF.

Karl Birkeland

Please also note the supplement to this comment:
<https://tc.copernicus.org/preprints/tc-2021-103/tc-2021-103-RC2-supplement.pdf>