Review of the paper **Development and validation using ground truth of a method to identify potential release areas of snow avalanches based on watershed delineation** by Cécile Duvillier1, Nicolas Eckert, Guillaume Evin and Michael Deschâtres

General comments:

The paper addresses an issue which is well-known in avalanche science. Potential avalanche release areas (PRAs) are one of the most important parameters to be identified for avalanche hazard assessment (for ex. hazard maps, design of defense measures, etc.).

The Introduction is very rich and refers to an exhaustive literature about the PRA definition topic. Good point! And it explains clearly which are the strong and weak points of existing methods, in particular about the validation method. At the end of the Introduction, then, it clearly states the aim of the paper, which is, beside the PRA definition method, also the development of a test and validation method (see my comments in the following).

Concerning the PRA delineation method: I think it is a good method which takes what already exists and adds a GIS watershed routine to define single PRAs. This part is more a GIS technical issue than an avalanche science issue… but it seems that the authors found a good solution to a challenging delineation problem.

Concerning the PRA validation method, I think that confusion matrix and evaluation scores are a good proposal… but the weak point is the pre-processing of the CLPA data. Finally, the authors apply the same procedure developed for the PRA identification to the CLPA database to extract the release areas from the polygons of the entire avalanche extensions… Therefore, they use the same method to produce the PRAs and, in a way, to extract a dataset to validate it. I mean, *we do what we can with what we have*, but then I would not stress so much the importance of the validation method - it is even in the title and using the word "ground truth". For me "ground truth" used in relation to potential release areas should mean observed release areas… Actually, this is the common problem of all the validation methods for PRA delineation, as not many release area datasets exist. For example, also Harvey et al. (2018) made something similar in the analysis of release areas of ski triggered avalanches. In the discussion section, this problem is actually well considered and truly presented. Though, I would not use "ground-truth"...

Stephan Harvey, Gunter Schmudlach, Yves Buhler, Lukas Durr, Andreas Stoffel, Marc Christen, AVALANCHE TERRAIN MAPS FOR BACKCOUNTRY SKIING IN SWITZERLAND, Proceedings, International Snow Science Workshop, Innsbruck, Austria, 2018 and presentation for the CSAW 2020 (https://www.oegsl.at/automatic-high-resolution-mapping-and-classification-of-avalanche-terrain-regarding-potential-release-triggering-and-run-out-zones/?lang=en time 3:16 - 3:22)

The Results and Discussion sections might be shortened… but, actually, the reader can easily follow the *file rouge* of the whole story, therefore for me it is ok like they are (but see later my comment to lines 447-463).

Specific comments:

Title: maybe it could be made simpler as follows: "Development and validation of a method to identify potential release areas of snow avalanches based on watershed delineation". This title doesn't stress too much the validation method, which is not really based on ground truth data, and instead stresses the watershed delineation which is something new in the PRA definition method. Or, even, the author could give a geographical information: "Development of a method to identify potential release areas of snow avalanches based on watershed delineation and validation in the French Alps".

From the abstract (very clear!) It seems that the authors develop a validation method which might be applicable also for existing PRA methods. This gives expectations to the readers…

About the Introduction: I think it should finish with the description of the aim of the paper, without the rest, which seems a bit like an abstract… giving already information on which has been found after the analyses (but this section is only the Introduction!). For example, I would move lines 109-116 ("Following … individual PRAs.") to the Results or Discussion sections. And I think it is not necessary to explain how the paper is structured… It comes naturally while reading. Eventually the authors can move the sentences at the beginning of the corresponding sections.

Line 28: ok for the reference to Amman and Bebi (2000) which is a general overview paper, while I would not refer to Braun et al (2020) which is a very specific one. Better, maybe, to refer to another general paper, or even a book (for ex. McClung and Shaerer, The avalanche handbook, 1993).

Line 28-29: I would cancel this sentence "No countermeasure… one minute." and "therefore" at line 31. I understood the message but I think it is not necessary here.

It is very good how the authors state the reasons behind the choice of the different inputs (for ex. lines 143-169… and also make a kind of sensitivity analysis about this (Sect. 4.2).

Line 181: I do not understand the reference to Figure 3… the sentence tells about areas without CLPA but the main outputs in Figure 3 are the resulting PRAs… Moreover, here we are still in Section 2. Data, therefore results should not be presented yet. I would cancel Figure 3. Instead, the authors might put a figure showing the areas covered by CLPA within the three test areas (Mont-Blanc, Chartreuse, Maurienne).

Line 232: Here it is not clear if the identification of individual watersheds is made automatically.

Line 259: I would specify that it is the **planar** area; also at line 265.

Line 316: I would move here Figure 3, which in fact shows the results of the PRA definition for the area of Chamonix. I think it is not necessary to highlight the pink area as "CLPA extension outside PRAs/AUTO"; "CLPA extensions" is enough. The figure would result less messed up (see Figure 7, S2 and S3, which are clearer).

Line 336: I would try to find a way to add a box (or a second figure) with a zoom on the area where CLPA exists (region in the lower-right corner) in order to better show the difference between matching (blue) and not matching (light blue) PRAs. Ok to put the other two figures (Mont Blanc and Maurienne) in the supplementary materials.

Line 447-463… these lines are a repetition of the Introduction… here it is time for discussion! :o)

Line 520-21… I do not understand the sentence… a verb is missing?

Technical suggestions:

<u>Figures:</u>

Figure 1. I would use a transparency for the violet and light blue colors to show the different study areas, so that the topography from the shaded DEM can be appreciated. **This is actually a general comment valid also for the other figures**.

Figure 5: point (3) should be in *italic* and I would substitute parts with **areas**. In the second blue rectangle I would simply write **forest** instead of forest parts.

Line 43: "Wider benefits can also arise **FROM** the systematic …"

Line 327: **PRAs** instead of PRAS

Table 2: At the end I would add a reference to Table 1 as a legend for the Confusion matrix.

Concerning the English: I am not the best person to judge the quality of the English… I would probably let the paper be revised by an English native speaker.