Open discussion https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-183/#discussion

Authors' response to RC1 review by anonymous referee. The response is shown in blue.

1. The use of expert survey

In our study we aimed at testing to what degree the users comprehended the intended message of the avalanche warnings. In order to do this we needed to find out what is the intended message, as defined by the sender (NAWS). This was done by letting the NAWS personnel (forecasters and observers) complete the survey and in this way defining what they meant the avalanche warning should communicate.

After this was done, weights were allocated to the answers, as described in chapter 2.3. Then an open survey was conducted, where the users could give their responses, the user survey.

There are probably several ways to do test how well the warnings are communicated. The method applied in this study compares the message as understood by the users with the intended message by those producing and publishing the warning. The user survey include respondents with different levels of experience and competence, not only novices. In fact, the users are novices, intermediate and experts. However, they are all users. On the other hand, the expert survey was restricted to NAWS personnel.

We will clarify this in chapters 2.1.1 and 2.1.2 by explaining that NAWS personnel participated in the expert survey, while all types of users participated in the user survey. Participants in the expert survey were NAWS experts (personal invitation only) and participants in the user survey were users (open invitation, anyone could participate). User survey participants included all types of users (various degree of competence and experience, from beginners/novices to experts; various types of use, from recreational to professional and preparedness). Expert survey participants included only forecasters and observers in NAWS, all trained in the same system.

2. Comprehension testing

We agree that testing the understanding of the avalanche warning by analysing actions and decisions in the field would be very interesting. Indeed, this was our first approach. However, we also had to establish the efficiency of the warnings more generally, for which using a web-based survey is appropriate (as it is less complex and easier to eliminate factors that are not attributable to the communication of the warning). Each method has its advantages and disadvantages. Web-based surveys are cost and time efficient, show high response rates and ensure voluntarily responding as the user without any costs can abort the study. Importantly, anonymous web surveys compared to active tracking in the field has high data security, i.e. we do not need to ask people to carry recording devices on their trip or requesting data logs from apps, which allows identifying the user. This often leads also to more honest answers, as users "know" they are anonymous, which is not the case in fieldwork. Field-based testing also has a few challenges. There is a large body of evidence showing that there is a major difference between behavioural intentions/attitudes and actual behaviour. Therefore, if we would focus solely on the behaviour in the field and found a miss match between this and the communicated warning, we would not know where along the line from information to action things went wrong - if this was due to lack of comprehension or rather risk seeking attitude.

We also believe a web-based survey is relevant, as many decisions are made based on the avalanche warning ahead of getting into navigation in the terrain. It could be decisions such as to choose forest rather than the alpine for today's trip, or delay the planned trip a few days until the snow stabilises. As cited in our paper, users do use the avalanche warnings, so the first thing to do should be to reassure us that the warnings are understood by the receiver as the sender intended.

We will describe the value of using web-based testing in more details in Chapter 1.4. At the end of Chapter 5, we will write that we recommend a follow-up study with in-the-field-testing, where avalanche problems and terrain choices are given much more attention.

Additional comments

1. P1 Line 20 – what is indented comprehension?

It is the message NAWS intend the users to understand and pick up. We will replace "comprehension" with "message".

2. P2 Line 27 – cite a reference for the 100 km^2 statement.

We will add "EAWS 2017", the EAWS MoU at https://lawine.tirol.gv.at/data/eaws/MoU_EAWS.pdf.

3. P2 Line 28 – Jamieson et al 2008 is not listed in the references

Thanks, will be added.

4. P3 Line 7 – add "locations" as part of recently observed avalanches in the region

Will be added.

5. P4 line 10 – I question calling avalanches a "low probability phenomena". Particularly in relation to other natural hazards, avalanches have an annual return period and many locations release multiple times per winter. I do not consider this low probability.

We will rephrase this sentence (we found this at line 11), and explain that many user have never or seldom experienced a release of an avalanche themselves.

6. Figures 1, 2 & 3 – these figures are mostly unreadable. I recommend making higher quality figures where the subject of the figures can actually be read. Currently only the general layout of the web screen is available from these figures. No detail can be read, yet this detail is essential to see the product that is being tested.

The purpose of Fig. 1 was to show the forecasting regions, which are readable. We may remove the rest of the web-page capture. The purpose of Fig. 2 was to illustrate the layout and elements included in the warning, not the detailed text. The text is in Norwegian, and the figure would span three pages if enlarged for readability. We may add a three-page enlargement as an annex. Fig. 3 could be enlarged for readbility, but would span two pages. The text is in Norwegian. We may add a two-page enlargement as an annex.

7. P4 Line 30 – typo halter? Should this say "halt"

Thanks for spotting this, will be changed.

8. Figure 2 – consider breaking this into 3 figures so that it can be read.

Ref. comments above.

9. P8 Line 12 – I do not think RegObs is the only open-access online real-time distribution system for avalanche forecasting (see MIN, Avanet).

As far as the authors are aware of, there is no other completely open-access online real-time distribution system. Other system lack open API's or restrict access to functionality or data partly or fully.

10. P11 Line 9 – Section D in Table 1. Typo? No section D in table 1.

Thanks, will be changed to "Table 2".

11. Figure 3 – same as comment on Figure 2 – currently the details of this figure are not readable, and they need to be since they are the basis for the testing. Break into several figures.

Ref. comments above.

12. Table 3 – I cannot find an explanation of the "4-scenario response". This needs to be clear as its not clear from just the table alone.

We will add an explanation of the two response columns in the caption. The figures are the percentage of respondents selecting the statement.

13. P12/13 – the description of how the communication effectiveness score was obtained is not clear. Despite reading several times, I remain unsure if I understand this. Ensure this method is explained well.

We will rephrase the description of the score.

14. P26 Lines 22/26 – We need to teach (1) is a poor header that does not communicate.

Thanks, we will rephrase this header.