

LOCAL AVALANCHE WARNING IN EUROPE

Christian Jaedicke^{1*}, Arnold Studeregger², Fabiano Monti³, Paola Dellavedova⁴, Lukas Stoffel⁵, Sergio Azzarello⁶, Carles Garcia⁷, Toni Molné⁸, Guillem Martín Bellido⁸

¹ Norwegian Geotechnical Institute, Oslo, Norway

² Lawinenwarndienst Steiermark, Graz, Austria

³ Alpsolut, Livigno, Italy

⁴ Fondazione Montagna Sicura, Courmayeur, Italy

⁵ WSL Institute for Snow and Avalanche Research SLF Davos, Switzerland

⁶ Meteomont - Carabinieri - Servizio Nazionale di Previsione Neve e Valanghe, Italy

⁷ Predicció d'Allaus. Institut Cartogràfic i Geològic de Catalunya, Barcelona, Spain

⁸ Oficina de l'energia i del canvi climàtic – Meteorologia, Andorra la Vella, Andorra

ABSTRACT: Avalanche exposed settlements, communication lines, ski resort operations, construction sites, tourism and professional guiding are only few examples of activities in the mountains where an active risk management requires local avalanche warnings. While regional avalanche warning is somehow standardized by the rules and standards of the European Avalanche Warning Services (EAWS), local avalanche warning services use a great variety of methods and tools both in the avalanche hazard assessment and in the communication of the results. To gain an overview of the different practices in Europe, the EAWS established a working group on local avalanche warning. The aim of the working group is to establish a general definition of local and regional avalanche warning and to outline the state of the art in Europe. A questionnaire in six languages was circulated in Europe to target local avalanche services collecting more than 200 answers. The analysis of the survey shows a large variety between local avalanche services, very different set-ups and applied methods for assessing and communicating the local avalanche danger. Based on the results of the questionnaire, a first definition of local versus regional avalanche warning assessment is presented.

KEYWORDS: avalanche warning, Europe, local, EAWS.

1. INTRODUCTION

Avalanche warning is provided at various scales in Europe reaching from forecasting for single avalanche runs to regional warnings for several hundreds of square kilometres. Most practitioners are familiar with the products of the regional avalanche warnings centres in their respective country (Studeregger et al, 2017). The products of these services are in general public and easily available through different channels of communication. The methods and products of the European warnings services are somehow standardized by the rules and standards of the European Avalanche Warning Services (EAWS) (European Avalanche Warning Services, 2017a). Contrary, the local avalanche services often produce avalanche forecasts that are adapted to local needs and conditions. The products are not necessarily available for the public but only for a selected user group. The work and methods of these local avalanche warning services are largely unknown for international colleagues and only a few experts that provide these services also participate in the scientific exchange. Nevertheless, many good

ideas, innovative approaches and procedures have been developed in these local services. In Switzerland a guideline for local avalanche control services exists since 2007 (Stoffel and Schweizer, 2008). The following study aims to approach the European local avalanche services and to gather information on their activities, methods, procedures and products. The study is conducted as an activity of working group three of the EAWS which evaluates the role of local avalanche warning in Europe.

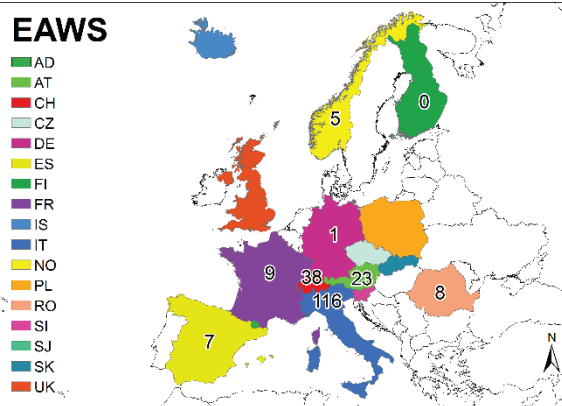


Figure 1. The Member countries of the European Avalanche Warnings Services and the number of answers to the survey / country

* Corresponding author address:

Christian Jaedicke, Norwegian Geotechnical Institute, Oslo, Norway
Tel. + 47 95 99 22 82
email: cj@ngi.no

2. MATERIALS AND METHODS

To approach the diverse group of local avalanche warning services in Europe an online questionnaire was developed by the EAWS working group. The primary aim of the questionnaire was to address the use of the EAWS standards of the avalanche danger scale and avalanche problems in the local services. In addition, organisational information was requested such as the size of the warning area, type of organisation and funding of the service. Furthermore, questions on the applied methods, the availability and use of stability tests, models, meteorological data and avalanche danger assessment methods were posed. Finally we asked the services to provide information on the dissemination of the results, whether they are public or private and by which means of communication they are spread to the users. The questionnaire consisted of 68 questions, many of which had multiple choice alternatives to make the analysis of the data easier. Since most of the local warning services work in their respective local languages, the entire questionnaire was translated to six languages (English, German, French, Italian, Spanish and Catalan). The questionnaire was distributed to all members of the EAWS with the request to further spread the questions to the local services in their country. The questionnaire was open to receive answers for about three months. The entire questionnaire can be found in the six languages on the EAWS homepage (www.avalanches.org).

3. RESULTS

In total N = 235 answers to the questionnaire could be gathered of which N = 208 can be considered as valid answers (Figure 1). Answers were received from nine countries (out of 16 member countries in the EAWS), most answers were collected from Italy (56%) followed by Switzerland (18%). Public services (local avalanche commissions) made 56% of all answers, 15% private consulting companies and 8% guiding companies (Figure 2). Over 50% answer that they have a local observer in their forecasting area and roughly one third has daily, one third weekly and one third has observations only in special situations. The public services are usually organized under the wings of the regional warning services and serve as the local executives in critical situations. Consequently, they mostly follow the same standards as the regional organization. The results for private consulting (N = 32) are more diverse and will be presented in more detail.

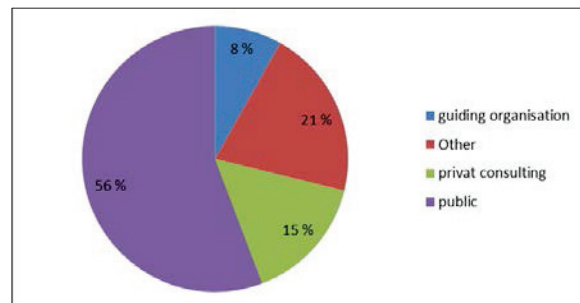


Figure 2. Distribution in the different categories of local services.

Most of the private consulting services (88%) have avalanche warning just a side business and most of them do not follow any DIN standards for quality control in their service. The majority only deals with avalanche hazard and not with risk assessments, but in contrary nearly 80% mention that they work with avalanche risk management. The physical presence in the forecasting area is similarly distributed as for all services. The local observers in the forecasting areas also collect manual snow observations. Over 80% of the services conduct local observations of snow profiles, weather, snow stability, new snow and total snow height. The size of the local warning areas has a wide span from 2 km² to 1000 km² and the number of avalanche paths covered also spans from one single path per service to several hundred paths. The majority of the private services covers up to 50 avalanche paths.

One of the major aims of the study was to elaborate the use of the European danger scale in local avalanche forecasts (European Avalanche Warning Services, 2016). Over 80% use the scale in their work and 41% actually produce their own danger level based on the scale (Figure 3).

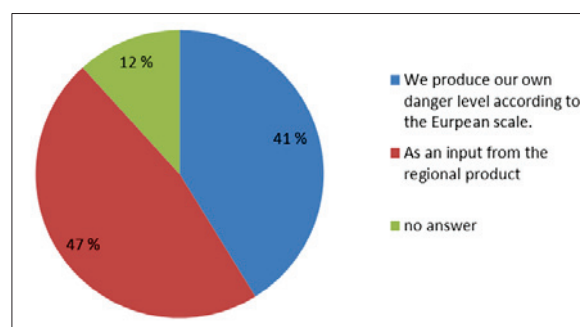


Figure 3. Percentage of the private consulting services that produce their own danger level.

The remaining 47% use the scale as a regional input to their local assessment (12% no answer). Only 19% have their own danger scale for the description of local conditions. These specialized scales are often adapted to local risk management systems. Nevertheless, only 41% of the services produce a hit probability for their forecasting

objects, most of them by using verbal (qualitative) scales. Only one service produces quantitative probabilities in percent for avalanche hits. A majority of 81% uses the avalanche problems as agreed by the EAWS (European avalanche Warning Services, 2017b). Most of the private consulting services produce their avalanche bulletin for a selected user group (customers or company internal) and the results are only published from 20% of the services that answered.

One of the interesting results is the use of the snow pack models in the local forecasting. Only 25% of all participants (N=208) confirm the use of such models. 75% do not use snow pack models in their work. In private consulting, only 5 of the 32 participating services use snow pack models.

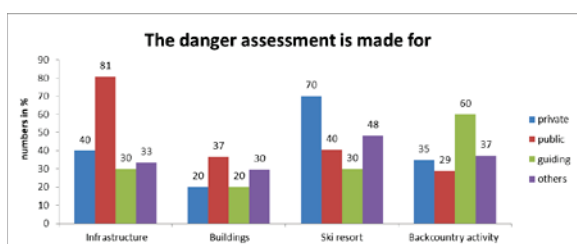


Figure 4. Activities covered by the Italian local services.

Italy has the highest number of replies on the questionnaire and a more thorough analysis of one country is possible (n=54 public avalanche commission, n=20 private consulting, n=10 guiding organisation, n=31 other). Most of the participating Italian organisations were public avalanche commissions followed by private consulting and guiding. Only 12% of the private consulting companies have avalanche warning as their only activity and most of them operate without a DIN quality assurance system. The Italian local services work mostly for infrastructure (public commissions), ski resorts (private consulting) and backcountry activities (guiding companies) (Figure 4).

The data used for the avalanche danger assessment is fairly equally distributed (Figure 5). The standard meteorological observations are mostly conducted by services that registered themselves as "other services".

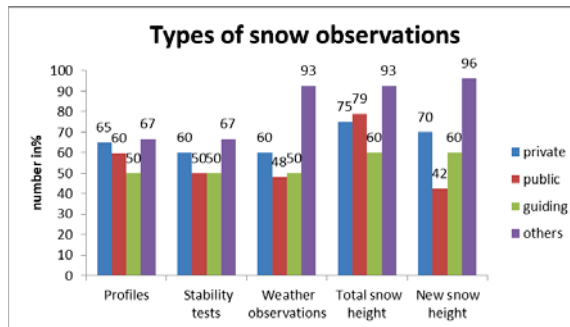


Figure 5. Typical snow observations conducted by the Italian local services.

In contrary to a wide use of snow observations, the use of snow models is very limited. Only a few percent claim to use such models in their hazard assessment work (Figure 6).

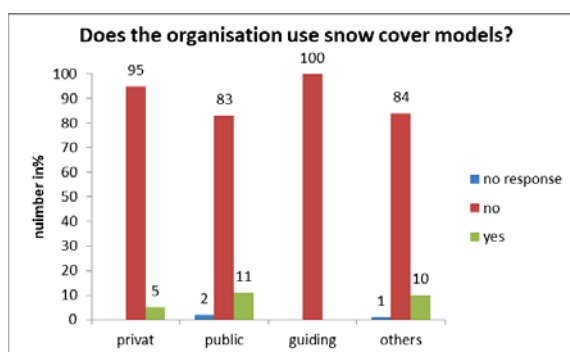


Figure 6. Use of snow cover models in the local Italian services

Most of the services use the European avalanche danger scale in their work (90%) and only the guiding companies apply their own danger scales. Most of the private companies did unfortunately not reply on this question.

Results from Italy agree well with the other countries on the free flow of data. Most participants answer that they have access to data from other organizations and that they share their data with others.

The Italian guides are the most active to visit their forecasting area and also 45% of the private companies are working in their area daily. Surprising 10% of the services answered that they never visit their warning areas (Figure 7)

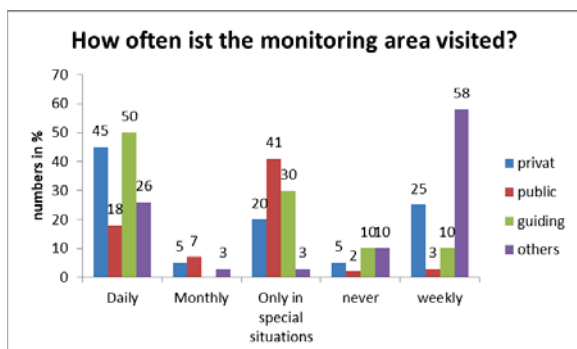


Figure 7. Presence of the Italian local warnings services in their forecasting area.

4. DISCUSSION

The results of the questionnaire give a first impression of the variety of local avalanche warning services in Europe. A large number organises as public avalanche commission as the local representative for the regional forecasting services. But a significant number works also independently in private consulting and guiding with forecasting the local avalanche situation. The range of activity is immense reaching from services that work with single avalanche paths to others that cover several hundreds of paths in areas over 1000 km². Common to all these services is that they adhere to the standards of the European Avalanche Warning Services by using the common European Avalanche Danger Scale and the agreed on avalanche problems. The question, whether the European Avalanche Danger Scale should be used in local avalanche warning is answered by the current practice that it is used by most local services. The fact that nearly 25% elaborate their own danger level according to the scale shows that the scale is in versatile use in Europa in local forecasting services covering from 5 – 1000 km².

Also the methods applied and the data used in the services seems to be rather uniform for all services and adheres closely to the perceived (but not documented) best practice of avalanche forecasting. The results from snow models are generally not used in local avalanche warning. The questions remains if that is due to lack of access to model results or distrust to the model output.

The main drawback with the results of this questionnaire is the missing data from many countries. Some countries as Germany and France are barely represented in the results and from Eastern Europe, the only answers are from Romania. We are quite certain that there are several more local services that could contribute to the survey. Nevertheless, the most important results are convincing and it is rather unlikely that the picture will be very different with more contributions from the underrepresented countries.

5. CONCLUSION

Avalanche warning in Europe is conducted on various scales from single avalanche paths to several thousands of square kilometres. The current survey by the European Avalanche Warning Centres shows that most local avalanche warning services adhere to the standards and routines that are considered best practice. The European Avalanche Danger Scale is widely used and the avalanche problems are adopted also in the local services. The frequency of data acquisition in the field and of issuing the forecasting product varies strongly and depends on the need of the local avalanche risk mitigation scheme. The survey shows that there are common aspects in all services that could be gathered in guidelines or standards for local services, yet other aspects such as the organisation of the service are more difficult to grasp in standard scheme for local European avalanche warning services.

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