ABUNDANCE OF INFORMATION TECHNOLOGY AND DATA PRODUCING THE AVALANCHE BULLETIN: WHAT ROLE DOES DIRECT OBSERVATION IN THE FIELD PLAY?

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ABSTRACT: Technology lets us quickly process information to produce increasingly accurate and detailed avalanche forecasts. However, a good forecast cannot be made without direct investigations of the snowpack, which allows the avalanche forecaster to understand the stability dynamics and snow evolution. Technology helps, but getting your hands in the snow is still crucial! Even though field investigations are designed to objectivise the personal assessments that everyone makes during a trip through the snowy terrain, there is always some subjective influence due to individual experience. The ability to evaluate in the field derives mainly from the experience of the surveyor-forecaster, the methodology used and the territorial context in which the activity takes place. This work aims to present the experience of the comparison made in the field by the AINEVA forecasting group during this 2023-2024 winter season and to highlight the need for comparison in the field between the various avalanche services (European, international, etc.) because data and computer processing make sense if we know what they mean in the field, and above all if we all interpret the actual snowpack conditions in the same way. Practical training in the field will always be necessary to consolidate an experience that will be challenged every time one approaches the practical application of snowpack knowledge. Comparison between different forecasters is the best way to improve and grow. From these meetings, the opportunity emerged to standardise route selection strategies and sometimes survey methods to reduce the uncertainty of assessments related to spatial variability as much as possible.

KEYWORDS: field evaluation comparison, wandering snowpack observations, avalanche forecasting, regional avalanche bulletin.

1. INTRODUCTION

Technology now allows us to quickly process a vast amount of information from the terrain to produce increasingly accurate and detailed avalanche forecast bulletins. However, a good forecast cannot disregard the direct investigation of the snowpack for the avalanche forecaster's understanding of the stability dynamics and snow evolution. Technology helps, but getting your hands in the snow is still crucial!

The AINEVA forecasters work nationwide, but each group is limited to a specific region. During the winter, each does their work independently, but we believe it is essential to meet in the field to compare the techniques and practical methods used. Although field investigations are aimed at objectifying the personal evaluations that everyone has during a trip to the snowy terrain, there always remains some subjective influence due to personal experience, both past and present, in the field.

The ability to evaluate in the field derives mainly from the experience of the observer-forecaster, the methodology used and the territorial context in which the activity takes place.

This work aims to present the experience of the comparison made in the field by the AINEVA forecasting group during this 2023-2024 winter season and to highlight the need for comparison in the field between the various avalanche services (European, international, etc.) because data and computer processing make sense if we know what they mean in the field, and above all if we all interpret the actual snowpack conditions in the same way. Practical training in the field will always be necessary to consolidate an experience that will be challenged every time one approaches the practical application of snowpack knowledge. Comparison between different forecasters is the best way to improve and grow.

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2. INITIAL COMMENTS

The first issue is to organise the collection of information in the field so that it is as homogeneous as possible from the point of view of the intended use of this type of information. In our case, we are talking about snow and avalanche information designed to draft the avalanche bulletin and, thus, as a first step for defining an avalanche danger level and the principal/secondary Avalanche Problem. Of these two aspects, it is fundamental to best describe the scenario by characterising critical slopes regarding altitude, exposure, and morphological situations to be specified in the text where necessary.

But the main question we asked ourselves was: are we aligned as evaluations of the avalanche situation first at the site level (in the area of interest of the field survey) and then extended to the territorial context at a larger scale?

As research on stability variability has already repeatedly shown (Birkeland, 2001; Kronholm, K., et al., 2002; Kronholm, K., 2004; Schweizer et al., 2008), the high spatial variability of the snowpack leads to an equal variability in stability characteristics. It is well known that the point results obtained from a stratigraphic analysis or stability tests can return opposite values even a few metres apart within the same slope.

Interpreting data collected in the field is a process that considers many factors that determine the spatial variation of snow stability characteristics, which cannot be defined a priori. Knowledge of the variability of snowpack stability on a regional scale is one of the objectives for avalanche hazard assessment. The contextualisation of the data is therefore of fundamental importance. The results of analyses performed using standard methodologies are undoubtedly objective data. However, the choice of location for measurements and the type of empirical analysis (classical or expeditive stability tests) is still primarily linked to a subjective factor and, consequently, could lead to different conclusions.

Generally, when preparing a field trip, the forecaster/observer has an idea of the situation to be expected in the field and, depending on the snow and weather data at his disposal, decides in which area he most needs to verify the conditions on the ground and what type of analysis to carry out. Then, in the field, these hypotheses must be validated or disproved based on the results he obtains.

This investigation aimed to discover the main differences or similarities in the field assessments of the different observers/forecasters on substantially the same terrain (considering a minimum basin scale in which to operate without significant interference), how one prepares for the collection of information in the field and how one performs the field analysis and then uses the data for the avalanche bulletin. The fundamental question is: is the same situation assessed similarly by different avalanche forecasters in a given area and time?

3. METHOD

We organised field days among AINEVA forecasters from the various regions, simulating a usual field trip in a snowy environment for stability assessment to produce the avalanche bulletin. We were divided into heterogeneous and independent groups (2-3 persons), each working independently. We then discussed, and each group detailed the strategies used, the observations made, and the conclusions reached.

Each group worked autonomously, both in terms of choosing the route and the analyses to be carried out in the field, from observation to stability tests, stratigraphic profiles, etc.

The analyses and data that can be observed in the field are often those that the surveyor decides to carry out to confirm or not confirm hypotheses previously made in the office.

To make the analyses comparable, locations were chosen that would allow different routes to be carried out on the same day, analysing different exposures, elevations, and slopes constantly within the same basin/complex to interfere with each other as little as possible.

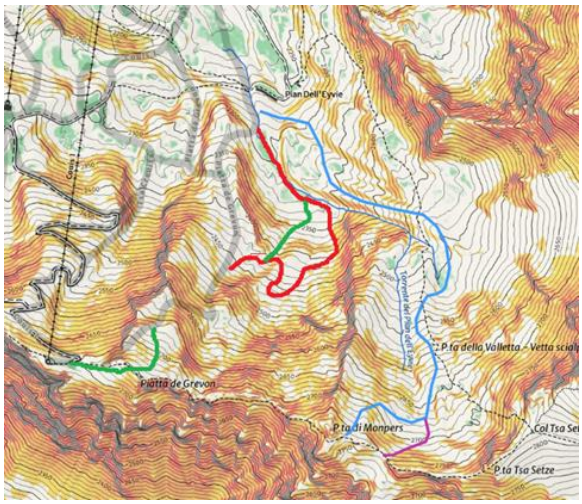

Fig. 01: Example of route planning within the slope map in the Pila (AO) area.

Each forecaster in their region has at their disposal the snow data of the automatic and manual stations, weather forecasts, recent stratigraphic profiles, snowpack model

calculations, as well as knowledge of the area's snow and orographic characteristics, the speed of snowpack evolution depending on the weather conditions, etc. For this reason, each participant had to analyse the data made available by the regional office of the area where the comparison took place to start with a minimum, homogeneous basic knowledge. In addition, the avalanche forecasters from the "host region" provided general information on the characteristics of the snow zone for their colleagues from the other regions before they went into the field so that they would have a more significant knowledge base for the assessment.

4. CONDUCT OF FIELD TRIALS

Two field days were organised in different areas of the Italian Alpine Arc to experience various types of territorial contexts of the Aineva offices.

One was held in the Italian Western Alps in Aosta Valley, in the Pila (AO) ski area, and the other in the Dolomites of the Veneto Region in the Passo San Pellegrino - Falcade (BL) area.

The day in Valle d'Aosta was attended by eight forecasters from the regions in which they operate as follows: three from Valle d'Aosta, three from Piedmont, one from Veneto and one from AINEVA, while the day in Veneto was attended by fourteen forecasters as follows: four from Veneto, four from Piedmont, two from Bolzano, two from Marche, one from Lombardy and one from Friuli-Venezia Giulia.

Fig. 02: Field meeting between forecasters from different regions on local avalanche danger assessments. 05th March 2024 in Falcade (BL).

On both field days, after a brief initial briefing with the latest information on the morphological characteristics of the area, a review of the routes and safety measures, and the previous and expected weather conditions for the day and following days, each group set out on its routes to gather the necessary information for evaluations in complete autonomy without any restrictive indications.

The following day, each group set out their assessments and considerations, comparing different field operating methods.

5. OUTCOMES

Some regions have little information from the ski areas (as they have less of a presence in the area) and, therefore, less direct information flow from the lift operators, which results in a greater need to collect ground information through direct surveys. In these territories, surveys are mainly carried out in locations outside the context of the ski areas and on routes that are as differentiated as possible in terms of type.

Other regions, on the other hand, thanks also to the capillary diffusion of ski areas, prefer to carry out field activities (daily surveys, stratigraphy and penetrometry of the snowpack, stability tests and itinerant observations) generally in the vicinity of the ski slopes and lifts, thus being able to analyse different altitudes and exposures more rapidly, even if in a more controlled context.

In some regions, snow and avalanche forecasters go out to the terrain an average of once a week, while in other areas, they go out almost daily.

In areas served more extensively by ski lifts, the frequent field trips allow forecasters to have constant feedback from the ground on the snowpack's evolution, thus frequently updating their estimates concerning the values measured by automatic stations and manual field gauges.

6. FINAL THOUGHTS

Differences in approach emerged due to local morphological and infrastructural conditions (mainly ski facilities or manned dams, etc.), similarities in direct assessments of the snowpack, and differences in methodological approach, although the final outcome was homogeneous.

Fig. 03: Evaluations of accumulations. Field comparisons help

weigh one's estimates and discern the analysis methods and stability tests to be carried out to evaluate the degree and avalanche problem. 27th February 2024 Pila (AO).

The conclusions reached by all were substantially homogeneous and similar: the degree of danger was identified by all the groups unambiguously, partly different from what was reported in the avalanche bulletin, also as a function of doubts dictated by local conditions of poor visibility and observation possibilities that limited the evaluation of the higher altitudes (as far as the experience in Valle d'Aosta is concerned).

On the other hand, the discourse on identifying the main avalanche problems was different. The groups, in some cases, evaluated different main avalanche problems.

However, the avalanche problem identified as secondary fell within the primary ones of the other groups. Thus, it is a different way of weighing and prioritising one critical issue over another. This was seen to be partly dictated by the various approaches and methods of investigation and partly by different assessments gathered in the field. For this reason, defining and sharing a homogeneous decision flow to refer to in the field assessment of avalanche problems may also be necessary.

This shows how variable the field assessment is depending on the terrain investigated. This aspect opens up the possibility of reflecting on the methods of investigation and terrain, the need to carry out field surveys, and the evaluations carried out with the data collected from the network from the Snowpack model simulations. Also, those carried out by operators/observers in the field must be supported by a direct on-site visit by the forecaster to weigh up and compare snowpack experiences to interpret better and use the data for the avalanche bulletin. Sometimes, due to difficult weather conditions (poor visibility, ongoing precipitation, etc.), the field visit does not allow the best appreciation and assessment of the stability conditions. Yet, it remains an essential element of knowledge. For example, when receiving information from other avalanche forecasters in the field, it is subject to subjective judgements; thanks to the information gained personally in the field, the avalanche forecaster can better weigh the information received and ask the right follow-up questions.

While it is essential to try to work in the field following a method to ensure that we do not forget bits and pieces and risk underestimating some aspects and conversely exaggerating others that may be less relevant, it is also essential to maintain a regular comparison directly in the field so as not to risk diverging overtime on the assessments of the actual scenarios.

A fundamental aspect to which everyone has been very attentive is that of safety; beyond the administrative formalities, in the field, the issue becomes a priority and the main reason for any limitation of ground investigations.

7. OPEN QUESTIONS

At the end of this overview of the situation in the Aineva regions, we ask ourselves some questions to open a discussion:

Are we all aligned in assessing the avalanche danger and problem conditions on the ground?

Do we all come to the same conclusions in the same field situation?

We believe an ongoing field comparison is essential to maintain the same parameters and remain aligned in direct field assessments to be extended to the avalanche bulletin sector to provide users with a comparable and truly unified product.

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