

Avalanche patterns as aid in avalanche forecasting

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ABSTRACT: Everyone who deals with avalanches over long periods of time automatically draws upon that experience when determining avalanche hazards. The principle always remains the same: one compares (often unconsciously) earlier situations with the current one. If there are similarities in the weather and the stratigraphy of the snowpack, one seeks a comparable avalanche situation. For some years now, the Avalanche Warning Service Tyrol has structured each winter season into clearly defined avalanche-relevant situations called "avalanche patterns". For each of these patterns, well documented case studies from other winters were first assembled, using snow profiles, data from the automated weather stations and numerous pictures, then applied in our instruction courses for avalanche officers. The feedback thus far is very promising and the objective is clear: In its initial phase, the avalanche commissioners must be trained to independently recognize such patterns, which will lend additional support to their work. The second phase will be to introduce this system to the public.

KEYWORDS: Avalanche pattern, avalanche forecasting, decision making

1 INTRODUCTION

The uniform European Avalanche Danger Scale, now in use for more than 15 years, has proved highly valuable. It helps the public to gain a first impression of current avalanche hazards. For a quicker understanding of the avalanche situation, the Avalanche Warning Services (AWS) have made assiduous efforts to further harmonize their avalanche reports. During the recent conference of the European Avalanche Warning Services (EAWS) in June 2009 in Innsbruck, Austria, it was decided not only to maintain the present course of clearly structured information on a descending scale of importance, i.e. starting with the most important message and proceeding to less important ones, but also to use some uniform icons. Only a flawless and easily grasped presentation, underpinned by professional communication, can guarantee that people will better understand what is going on in the field.

Furthermore, in recent years the AWS Tyrol has explained each current avalanche situation to its avalanche commissioners with so called avalanche patterns. The idea is old and similar to NXD (BUSER, 1983,1989), albeit with the major difference that now the primary focus is on the stratigraphy of the snowpack as the current situation is compared with historical ones.

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2 AVALANCHE PATTERNS

Good avalanche forecasting must always be based on the structure of the snowpack and the influence of the weather on the snowpack. Similarities of both factors will lead to similar avalanche-relevant situations (patterns). Thus it is no coincidence that avalanche accidents occur at similar times at similar places / spatial distribution during analogue conditions.

Because of this, a system to these occurrences was sought and their structure pursued. First, periods which are dangerous to backcountry skiers and of interest to avalanche commissioners were focused on. Then, periods with stable conditions were integrated into the system. In the final analysis, it became possible to structure the entire winter season in typical and easily recognizable patterns.

2.1. Classification of patterns

There are different ways to classify avalanche patterns. Initial endeavors took into account the most significant patterns for avalanche commissioners. The following ones were selected:

- * Cold period -> (intense) snowfall and / or wind -> (warming)
- * Unusually heavy snowfall
- * Spring situation (combination of radiation, temperature and humidity)
- * Rainfall
- * Damp / wet old snowpack -> cold front
- * Distinct layer of depth hoar covered by small amount of bonded snow

The classification was quickly adopted by the practitioners although it was soon discovered that there was still ample room for improvement (especially for the public).

For that reason, in future a first, quick orientation with a couple of independent criteria which will help to localize the best-fitting pattern will be used. Those criteria which also include HARVEY's (2009) are:

- * Stability (stable, unstable conditions)
- * Time (early season, mid-winter, spring situation)
- * Snowpack (problem with new snow, old snow or a combination of both)
- * Special situation (quick rise, quick decline of danger, tricky cases)

In the second step, a detailed description of the snowpack, its ongoing development and the weather-related consequences to the snowpack is provided. A clear name (which in some cases has yet to be defined by the working group of the EAWS) will further help to clarify and impact such situations.

2.2. Case studies

Based on the motto "A picture is worth more than 1000 words" we have assembled well documented case studies for each pattern from a variety of winters by using snow profiles, data from automated weather stations and numerous pictures.

The plan is to publish those case studies (as well as others) in different languages on www.avalanches.org - the website of the EAWS. The idea is to link the current avalanche report to its specific corresponding pattern.

3. OUTLOOK

These efforts are based on the conviction that the integration of avalanche patterns into the great info-pool of the Avalanche Warning Services will be very helpful for everyone in the following ways:

Avalanche Warning Services will benefit from smoother harmonization with avalanche reports. The public will get a more precise picture of the current avalanche situation.

Finally, there remains the most important issue of all: We believe this tool will help save lives.

4. REFERENCES

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