Avalanche Warning Service Tirol

Avalanche Danger Patterns (dp)

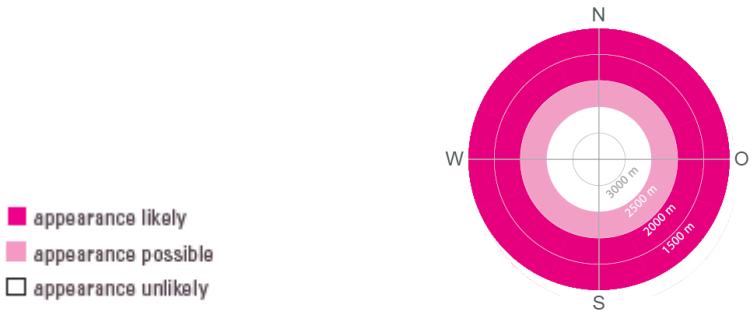
Introduction

Experience has shown that even over the course of highly varied winters, nearly identical potential-avalanche scenarios repeatedly arise as recurring danger patterns and are responsible for the greater part of avalanche accidents. An analysis of these patterns was published in the practical handbook “Avalanche - Recognizing the 10 Decisive Danger Patterns” by Rudi Mair and Patrick Nairz in November 2010.

Aerial classification

Each avalanche danger pattern (dp) occurs mainly in specific altitudes and aspects, partly also in specific regions.

You can observe e.g. the avalanche danger pattern (dp) 3 – rain during a winter mainly below 2000m sea-level, where it influences negatively the snow-cover in all aspects.



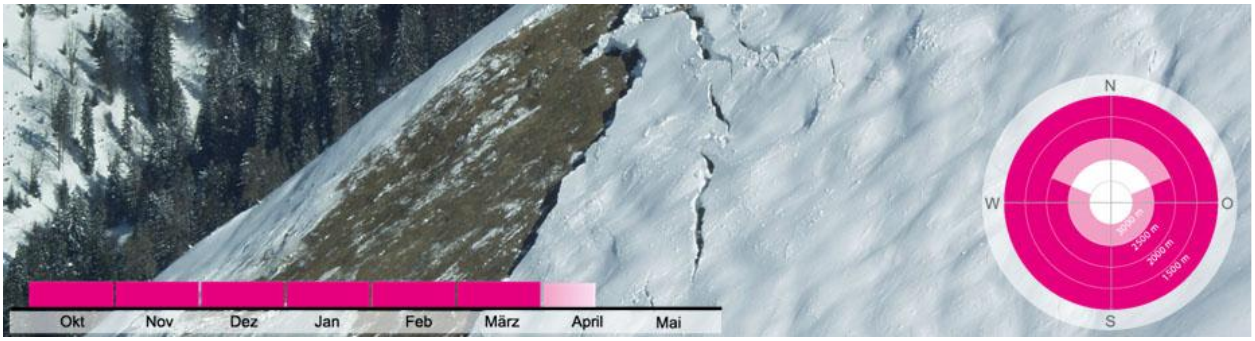
(Changes since winter-season 2013-2014 at dp.1 and dp.7 in "red")

Danger Pattern (dp) 1 - deep persistent weak layer

At the beginning of the winter you'll observe an increasing number of slabs after the second snowfall at high altitudes (>2000 m) and in high alpine regions (>3000 m) on steep, shady slopes. The reason the second snowfall is so important is that in the interim between the initial snow base and the second snowfall a distinctly weak layer often forms which can be easily triggered by skiers and snowboarders. This deep persistent weak layer mainly causes problems at the beginning of the winter, but can negatively influence the snowpack till the end of the season.

Danger Pattern (dp) 2 - gliding avalanche

Gliding avalanches are usually unleashed down towards the valley across steep, smooth slopes. Before they are released glide cracks form, i.e. easily visible fissures in the snowpack, often several meters deep. Quite opposed to an age-old belief which is still difficult to dispel, such glide cracks are now known to be not favourable signs, but on the contrary, thoroughly unfavourable harbingers of gliding avalanches. A glide crack points to the possibility of a gliding avalanche, though gives no indication about whether a snow mass will actually be triggered and, if so, when. Gliding avalanches are among the most difficult types of avalanche to predict, in terms of their time of triggering, because they can be released literally at any time of day or night even in generally stable snow conditions, on the coldest day of winter or the warmest. Furthermore, gliding avalanches are not unleashed by additional loading.



Danger Pattern (dp) 3 - rain

Rain is considered the classic alarm signal in snow analysis and avalanche science, since on the one hand, it funnels additional weight into the snowpack, and on the other, rapidly diminishes the snowpack's firmness. Avalanches are then bound to be triggered. Rainfall can occur at any time of the winter. The biggest advantage is: this is the simplest danger pattern of all to recognize.

Danger Pattern (dp) 4 - cold following warm / warm following cold

Since ages past in avalanche lore, the opinion was handed down that a big temperature change during heavy snowfall (regardless whether cold following warm or vice versa) had a beneficial influence on the avalanche situation. In fact, this is the case only under certain, very specific conditions. Far more often, such a temperature change has a negative effect, since it enhances the faceting of snow crystals inside the snowpack, as a rule leading to the formation a thin, weak layer which is highly prone to triggering. Such layers are often found in south facing terrain. They are highly treacherous, not least because immediately following the snowfall they don't yet exist, but form only over the course of subsequent days.

Danger Pattern (dp) 5 – snowfall after a long period of cold

A classic scenario in avalanche situations: following a long period of low temperatures, it begins to snow. In addition, a strong wind is blowing, which transports the freshly fallen snow. Within the shortest imaginable time, an extremely treacherous situation for skiers and boarders arises. Yet this is equally true when, following a long period of low temperatures, 'merely' a strong wind blows, without any snowfall. The underlying problem: on wind protected slopes, fresh snowdrift accumulates which usually is deposited atop an old snowpack consisting of depth hoar. The old snowpack and new snowdrift are very poorly bonded to each other. The snowpack then just waits to be triggered by a new disturbance.

Danger Pattern (dp) 6 – cold, loose, new fallen snow and wind

"Wind is the architect of avalanches" this classic adage of Wilhelm Paulcke from the 1930s still has unaltered validity today. Wind influences both falling snow and already deposited snow, it is one of the major formative factors in potential avalanches. If the snow is loosely packed and dry, wind always leads to its transport, thus increasing the danger of avalanches.

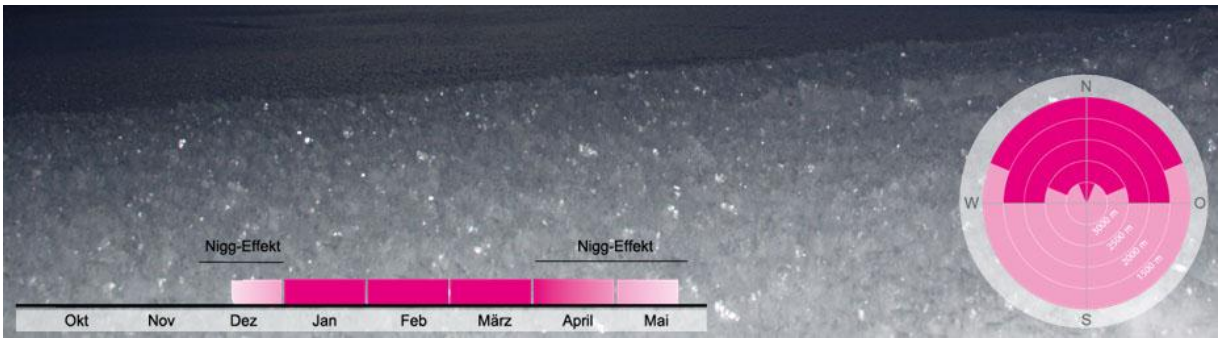
The colder the transported snow is, the more sensitively it reacts to additional loading, since it becomes even more brittle. This danger pattern is distinct from dp.5 in that the cold, loosely packed snow has not formed over a prolonged cold period, but in a very short time. That means, it either snowed just previous, in low temperatures without wind, and subsequently the wind begins to blow; or it begins to snow without wind, and the wind increases in velocity during the snowfall. This pattern is easy to recognize as a rule.

Danger Pattern (dp) 7 – snow-poor zones in snow-rich surrounding

In winters with lots of snow, far fewer avalanches are generally unleashed than in winters with little snowfall, since the snow layering is generally far better in snow-rich winters. Nevertheless, it can regularly be observed, also in winters with lots of snow, that due to prevailing weather conditions, slopes exposed to wind have relatively little snow. In such areas, the snow layering is less favourable. And thus, it is far more likely that avalanches get triggered by backcountry skiers and snowboarders in those zones. You can observe this phenomenon also during a winter with an average snow-cover, if there are snow-poor zones in a snow-rich surrounding. Problems will mostly occur on convex slopes or in the vicinity of ridges.

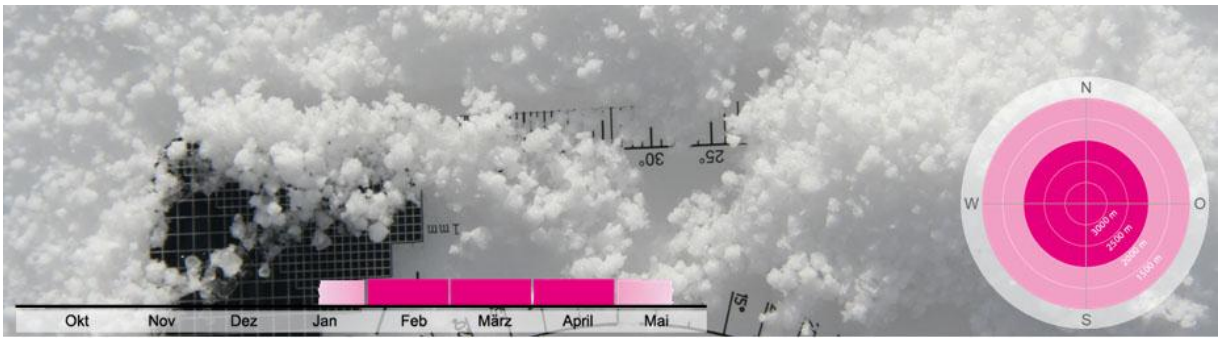
Danger Pattern (dp) 8 – surface hoar blanketed with snow

Surface hoar, aesthetically, numbers among the most beautiful types of snow. It is not a potential danger in itself. However, when it is covered over by new, bonded layers of snow it becomes a peril and is thus considered, with reason, to be one of the most critical weaknesses in snow analysis and avalanche science.



Danger Pattern (dp) 9 – graupel blanketed with snow

In avalanche instruction courses, weak layers inside the snowpack are often compared with ball bearings. Yet this image is suitable only for graupel: a ball-shaped form of precipitation which is deposited in thunderstorm-like showers particularly in springtime. It is easy to grasp that snowdrift which collects on top of it is usually inadequately bonded with it, and the avalanche danger thus escalates. Graupel is often spread over small areas and is very difficult to spot, even by experts, without looking inside the snowpack. It is a thoroughly treacherous situation, which fortunately causes problems only for short periods of time.



Danger Pattern (dp) 10 – springtime scenario

A particular challenge for backcountry skiers and boarders (and for avalanche analysts as well) arises in springtime. Rarely do situations considered “safe” and those considered “unsafe” occur so close together in time. And never is the spectrum of danger levels in a daily cycle as divergent as in spring. On the one hand, the avalanche danger is easy to assess in conditions of stable firn snow; on the other, there are never as many large avalanches registered in the course of a winter as during critical springtime situations.

Apart from the snow layering, a complex interaction of air temperature, humidity, solar radiation and wind exerts an enormous impact. For skiers and snowboarders, clocktime-discipline and flexibility in planning backcountry tours take on preeminent importance.