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AVALANCHE KNOW-HOW

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Avalanche know-how

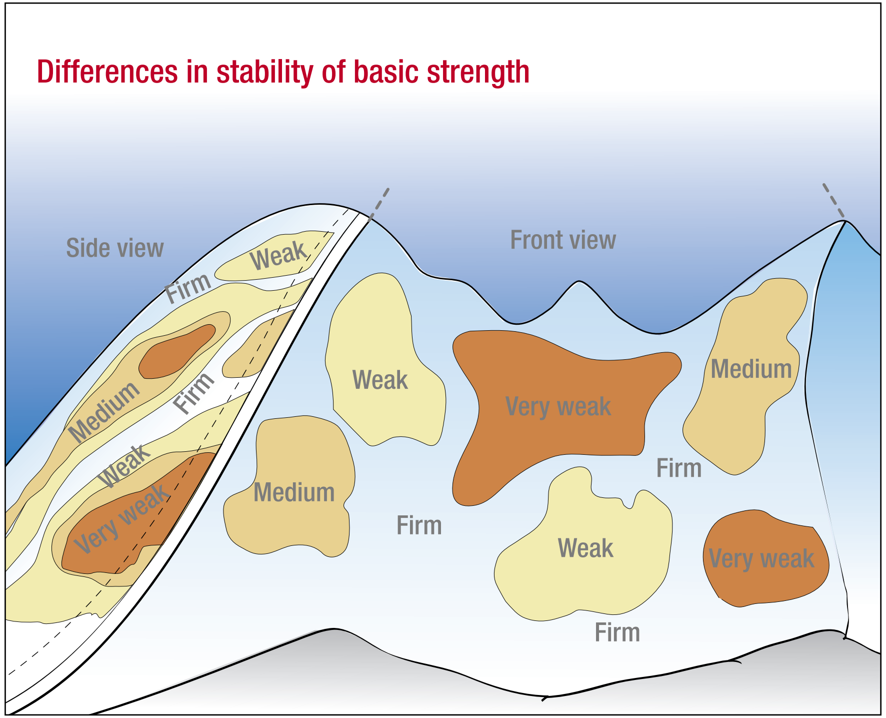
Because of the significant differences in strength throughout a slope, individual snowpack tests can say nothing about the stability of the whole snowpack.

Areas of low strength within the snowpack

The slope is stable and settled if the basic strength at every point on the slope is sufficiently high to carry the weight of the overlying layer. Usually, however, the basic strength throughout the individual layers is not the same. Differences in stability can range from very good to very weak. Areas where the basal strength is less than the gravitational pull on the slope are called hotspots.

Hotspots

Hotspots are layers that are easily deformed and which therefore constitute a critical layer. Examples are depth hoar (sugar snow), buried surface hoar and a crust with an overlying layer. Areas of low strength destabilise a slope. The probability of triggering an avalanche is greatest in a hotspot. The greater the number of hotspots on a slope, the more critically the slope must be assessed.

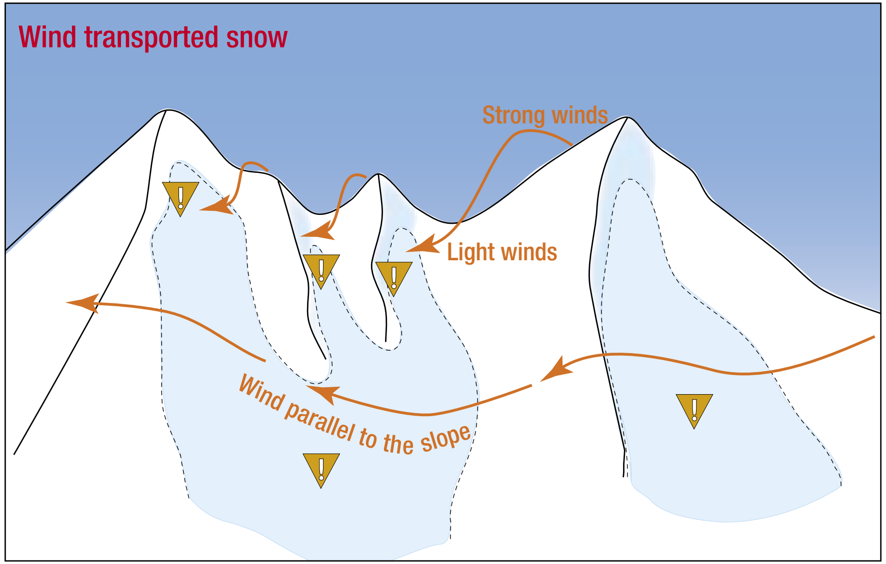


'Wind is the builder of slab avalanches.' This old saying is a reminder that wind creates inhomog–eneities in the snowpack.

Avalanche danger is highest during a snowfall and for a few days afterwards, as the new snow has not yet bonded with the underlying layer. After a period of warming on the first day of fine weather, loose snow or slab avalanches often release. Even low new snow depths of 10-20 cm, blown by strong winds onto an unfavourable old layer such as a melt-freeze crust or surface hoar, can form a considerable slab avalanche hazard. It is not the new snow itself that is the decisive factor, but conditions during and after the snowfall. Conditions during the snowfall have a considerable influence on the stability of the snowpack.

1.2 Wind

During a snowfall, individual snow crystals are broken down and deposited on lee slopes by the wind. Wind-transported snow is deposited mainly behind ridges on the lee of a slope. On the windward side, snowdrifts can build up as slabs in hollows and gullies. Wind-transported snow is closely packed, and this creates large areas of stress within the snowpack. Furthermore, snowdrifts do not bond well with the underlying layer.



The amount of snowdrift depends on the structure of the terrain and the orientation of the slope. The structure of the snow surface is changed by the wind. If the wind-affected surface is buried, it influences the distribution of strength within the snowpack. Hollows and gullies are filled by snowdrifts, while snow is blown off crests and ridges. This process covers the underlying terrain, making it difficult to assess the shape and inclination of a slope.

The stronger the wind, the bigger the snowdrifts and the greater the number of slope inclinations affected.

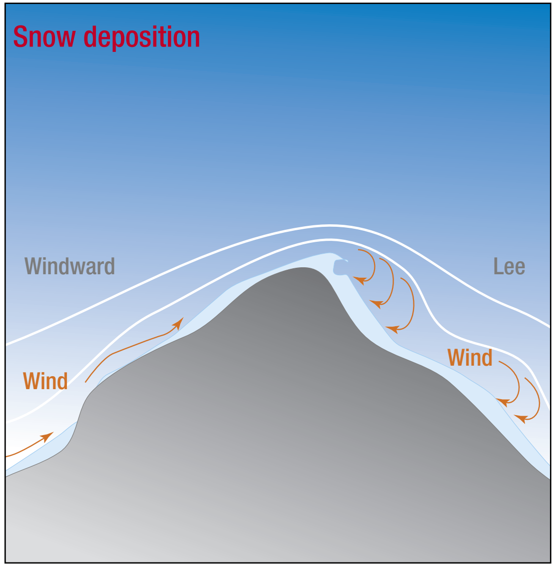
Assessment of wind-transported snow

A slope with wind-sculpted shapes and structures allows conclusions to be drawn about the direction and speed of the wind.

Wind signs in the snow

Wind signs are important indicators of the size and position of snowdrifts (Figure 1, Cornice; Figure 2, Sastrugi).

- Cornices
- Sastrugi
- Dunes and blowout



Avalanche science
Mechanisms of avalanche release

Areas with weak layers (hotspots) are an invisible source of danger within the snowpack. Existing tracks provide no guarantee that a slope will be safe next time.

Mechanisms of avalanche release

A slab avalanche requires certain conditions, such as a cohesive unit of snow, a slide plane and sufficient steepness. Additional loading increases the stress within the snowpack, until overloading causes the snowpack to fracture.

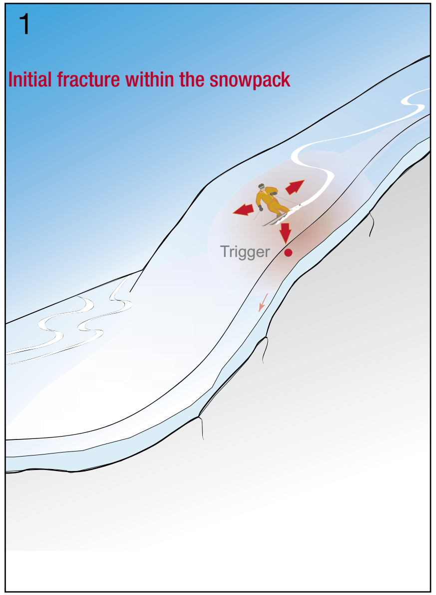
The two phases of a slab avalanche

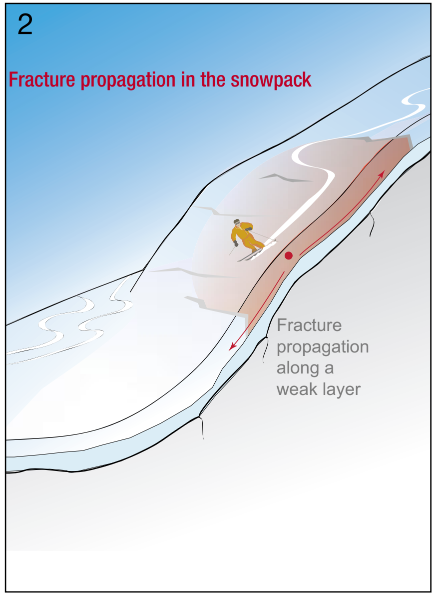
1. Initial fracture

If the basal shear strength (the basic strength) is exceeded due to an additional load, a crack (the initial fracture) forms along the layers and rapidly propagates to all sides along the weak layer. A layer of snow separates from the weak underlying layer (Figure 1).

2. Fracture propagation

If the fracture continues to propagate, the boundary strengths are affected. As the boundary strengths (tensile strength, compressive strength and lateral shear strength) become overloaded, a secondary fracture is produced. The entire layer slides on the bed surface as a slab (Figure 2).





A slab avalanche can occur in two ways:

- Natural release
- Artificial trigger

An avalanche occurs naturally when snow, wind or rain increases the weight on the snowpack to the extent that stresses within it reach breaking point.

An avalanche is triggered artificially when the snowpack cannot withstand the additional load produced by a skier, rider, walker, snowmobile, or avalanche blasting. The amount of loading determines the outcome.

Remote triggering

A trigger can be on or adjacent to the slope. Remote triggering occurs when an avalanche is triggered from an adjacent area, by people or by blasting. If the snowpack is sufficiently weak, it can be triggered from hundreds of metres away, including from flat terrain (Figure 1).