

Avalanche Problem Essentials – Loose Dry and Loose Wet Snow Avalanches

This document is part of “Decision Making in Avalanche Terrain: a fieldbook for winter backcountry users” by Pascal Haegeli, Roger Atkins and Karl Klassen and provides in-depth background information for on the topic of Avalanche Problem Essentials. For additional background information on the topics covered in the field book visit www.avalanche.ca/cac/decisionmaking

Loose dry avalanches are usually confined to surface layers, and therefore are often small. They contain loose cohesion-less dry powdery snow. They start from a point and gather mass progressively in a fan-like shape.

Like loose dry avalanches, loose wet avalanches are usually confined to surface layers, and are therefore often small. However, because of their high density, loose wet avalanches contain greater mass and are much more difficult to fight against than loose dry avalanches. They contain cohesion-less wet slushy snow, and like loose dry avalanches, they start from a point and gather mass progressively in a fan-like shape. They are also sometimes called "point releases." In periods of significant, prolonged melt or rainfall loose wet avalanches can become large and destructive but this usually occurs in conditions where recreational activities are highly undesirable or impossible.

Development

Loose snow avalanches are also sometimes referred to as sloughs, sluffs, or point releases. Loose snow avalanches occur in cohesion-less surface snow. Dry loose snow avalanches can occur in newly fallen snow or in old surface snow that has faceted. Wet loose snow avalanches occur when the surface snow loses strength by becoming wet due to melting caused by warm temperatures, solar radiation, rainfall or a combination of these factors.

Time of the Season

Wet loose avalanches are most common in late winter or spring. Dry loose avalanches of faceted snow are most common in early to mid winter. Dry loose snow avalanche in newly fallen snow can occur at any time of the season.

Weather Patterns

Each type of loose snow avalanche is related to a different weather pattern.

Dry fresh loose snow avalanches associated with new snowfall generally occur during or shortly after a storm before surface layers of new snow have settled and gained strength.

Dry faceted loose snow avalanches are associated with extended periods of clear weather, which causes the surface snow to become sufficiently faceted to lose cohesion..

Wet loose snow avalanches are associated with wet surface snow caused by warm temperatures, strong solar radiation, rain, or some combination of these factors.

Snow Climates

Loose snow avalanches occur in all snow climates.

Spatial Distribution

Loose snow avalanches require sufficiently steep slopes to initiate, generally at least 35 degrees and typically 40 degrees or more. Loose snow avalanches often start in steep, rocky terrain but can also be triggered in smaller steep glades and slopes.

Dry loose fresh snow avalanches are generally larger and more common at higher elevations where snowfall accumulations are greater and the snow that falls is less dense.

Wet loose snow avalanches associated with solar heating are related largely to aspect, incline, and elevation. Sunny aspects gain significantly more solar radiation. On sunny aspects, steeper slopes collect more heat. Higher elevations receive sun earlier in the day and for longer periods. Wet loose snow avalanches associated with warm temperatures can occur anywhere temperatures become warm enough to cause melting of the snow surface. Wet loose snow avalanches associated with rainfall are limited to elevations below the snow line.

Avalanche Activity Patterns**Seasonal Timing and Persistence**

Dry loose new snow avalanches can occur at any time of the season. They generally persist only for a few hours although in cold, clear, dry conditions they may persist for several days after snowfall.

Similarly, dry loose avalanches of faceted snow can occur at any time. This condition can persist for days or perhaps a week if dry, cold, clear weather remains entrenched. It is important to note that surface facets that produce loose snow avalanches are likely to become a persistent weak layer once buried.

Wet loose snow avalanches are generally more common in late winter, spring, and late spring when solar radiation is stronger, temperatures are warmer, and the potential for higher intensity rainfalls with greater accumulations are more likely.

Size and Propagation

Loose avalanches are generally small, usually less than a size two and tend to involve only small portions of the avalanche path. The exception is larger loose wet avalanches triggered by extensive warm and sunny weather and perhaps with the addition of rain. These conditions can produce avalanches larger than size two, although they are generally not an issue until late spring, often after most winter recreational activities have ended.

Loose snow avalanches do not propagate as a fracture line, but start at a point and then collect more snow and get wider as they move downhill. It is common for multiple loose snow avalanches to start at different points and then join together.

Spatial Distribution and Variability

Loose avalanches triggered by solar radiation are most prevalent on southeast through west facing slopes. Early in the season, slides are more common on high elevation, steep inclines, while later in the season less steep slopes at lower elevations can also be triggered.

Loose avalanches triggered by warm temperatures or rain are often widely distributed in terms of aspects and slope incline but variability over elevation is common: in a normal atmosphere, lower elevations are generally more prone to slides; if a temperature inversion or above freezing layer of air exists, higher elevations may be more prone to avalanches than lower.

Loose avalanches due to new snow are generally widely distributed over elevations and aspects.

Loose avalanches due to faceting are often more prevalent on shaded north through northeast aspects.

In all cases, a very firm, smooth layer below the loose snow on the surface tends to enhance instability.

Triggering

Loose snow avalanches can often be triggered easily by ski cutting or started accidentally while skiing or traveling in steep terrain. Loose snow avalanches are generally not triggered remotely and are usually triggered at the point where the snow is disturbed, not involving snow from above.

Weather conditions that promote natural triggering include:

- Storms with high precipitation intensities (>4cm/hour) and significant new snow accumulations (>50cm in a 12 hour period).
- Sudden warming of the snow surface, rocks, or trees due to solar radiation (e.g. sunrise, dissipating cloud).
- Prolonged periods of above freezing temperatures.
- Any amount of rain on a loose, dry surface.
- When the surface is firm, rainfall events with high precipitation intensities or accumulations, which saturate surface layers.

If more than one of these weather conditions occur together, the effect is greater than the sum of its parts.

Avalanches triggered by solar radiation or warm temperatures often go through a diurnal cycle in which stability decreases significantly (and often rapidly) as the sun comes up and temperatures rise, followed by an increase of stability late in the day and overnight as solar radiation drops off and temperatures fall.

Recognition and Assessment in the Field

Avalanche Activity

Wet loose avalanches often occur in diurnal cycles due to varying solar radiation rates and temperature fluctuations.

Snowpack Layering, Tests, and Observations

The weak layer is on the surface and is readily observed. Generally, loose snow avalanches are limited to depths of 50cm or less, although the exception may be when thicker layers or even the entire snowpack is saturated with water.

The ease of triggering, size, and power of loose snow avalanches can often be assessed by observing natural activity and by observing the results of careful ski cutting. Slopes can be tested by applying a trigger such as a rock, small cornice, or even a snowball.

Evidence of loose snow avalanching in fresh storm snow is often considered a positive sign indicating that the storm snow is not reacting as a cohesive slab.

Early signs of instability include:

- Pinwheeling.
- Snowballing.
- Spindrift.

Surface Conditions

Surface conditions are highly indicative of instability. When loose, unconsolidated snow is observed, especially during periods when new snow, faceting, or melting exist, the potential for loose snow avalanches and their consequences should be considered.

Risk Management Strategies

Slab avalanches are perceived as being much more dangerous than loose snow avalanches, but loose snow avalanches can be large enough to pose a threat to people. Even smaller loose snow avalanches can be a danger if the snow accumulates in a terrain trap or if the moving snow carries a person into obstacles or over cliffs.

Timing

Avoid travelling in avalanche terrain during periods of rain. Consider the likelihood that a diurnal avalanche cycle may be underway due to fluctuating temperatures and solar radiation. Consider the timing of solar radiation on slopes high above, where the sun may be strong much earlier and for much longer than in shaded valley bottoms.

Human Factors

Because loose snow avalanches are considered less hazardous than slabs, there may be a tendency to underplay the consequences. In conditions conducive to dry loose avalanches, the lure of powder snow on steep terrain may over-ride the risk assessment process that should take into account factors such as terrain traps, which can significantly magnify the consequences of being caught. Skiers and boarders tend to underestimate the hazard of loose snow avalanches when skiing in trees where treewells exist.

Terrain

To manage the risk of loose snow avalanches, avoid situations that could result in being caught in a terrain trap or carried into obstacles or over cliffs. Loose snow avalanches

can often be started by careful ski cutting and the slopes below can then be descended more safely after much of the loose snow has been cleaned off.

When descending large steep slopes, be aware of sloughs that gain size and speed from behind you. Travel on ribs and high ground to avoid sloughs that accumulate in gullies, and avoid situations that expose people to sloughs triggered by people above, especially if there are terrain traps (e.g. gullies or tree wells) in the area.

If the loose snow avalanches are too large and fast moving to manage safely, then avoid terrain that is capable of producing large sloughs until things settle down.

Small loose avalanches can be managed by a process of slough management. By descending a slightly diagonal fall line, any loose avalanches that are triggered will slide beside instead of above you. If caught in a small avalanche that is gaining mass, pull out to the side (ideally onto high ground) as soon as you begin to feel loss of control or manoeuvrability.

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