Storm Slab Avalanches

Introduction

Storm snow avalanches are caused by a cohesive slab of new snow overloading the bond at an interface within the storm snow or at the old surface if it forms an underlying weak layer. These slabs are often quite soft compared to other slab types and this can fool people into underestimating the potential for a slab avalanche. The moving snow often involves a significant powder cloud and the avalanche debris tends to be soft and powdery. Storm snow avalanches tend to release below the trigger, making it somewhat easier to escape if you trigger one. During and shortly after significant storms involving rapid accumulations of significant new snow amounts, storm snow avalanches can be very large and destructive.

Development:
Storm snow instabilities form when a storm deposits a slab of stronger snow over a weaker layer of storm snow, or when the upper layers of storm snow settle and strengthen into a stronger slab resting on relatively weaker storm snow. Alternatively, storm snow can fail at the old snow interface that was on the surface when the storm started.

Time of the Season:
Storm snow avalanches can occur at any time of the season.

Weather Patterns:
The relative weak layers and slabs required to produce storm snow avalanches are formed by fluctuations in the snow types falling in the storm. Stellar dendrites and graupel are common weak layers leading to storm snow avalanches. Warming temperatures and/or increasing winds during a storm can lead to 'upside-down' storm snow conditions (denser, more cohesive snow over lighter, less cohesive snow) that may produce storm snow avalanches.

Therefore, storm snow avalanches occur during and immediately after periods of snowfall, but not all storms create storm snow instabilities. Storms associated with more violent weather having periods of high or fluctuating snowfall intensities, fluctuating temperatures, and fluctuating wind or winds that increase late in the storm are most likely to produce storm sow avalanches. Less violent storms with slow, steady snow accumulations, more constant temperatures, and little or no wind are less likely to produce storm snow instabilities.

Snow Climates:
Storm snow avalanches can occur in any snow climate, but the larger snowfalls in maritime and interior snow climates tend to produce more frequent and larger storm related avalanches than are typical in the continental snow climate.

Spatial Distribution:
The larger the storm, the more widespread the problem will be on a geographic scale. Storm snows tend to develop sooner and be larger at higher elevations where the amount and intensity of snowfall is greater. However, storm snow avalanches can occur in sufficiently steep and open terrain at any elevation.

Avalanche Activity Patterns

Seasonal Timing and Persistence:
Storm snow avalanche activity generally peaks during periods of intense snowfall and tend to stabilize quickly (within 24 to 36 hours) after the snowfall stops. Cold temperatures may cause storm snow instabilities to persist a little longer. Storms snow deposited on top of a persistent weak layer grain type (surface hoar, facets, depth hoar) may develop into a persistent slab instability instead of stabilizing quickly. Once a storm snow instability has stabilized, it is unlikely to become unstable again although additional loading on a partially stabilized storm snow instability may produce additional avalanches.

Size and Propagation:
The potential size of storm snow avalanches depends on the intensity of the storm. Storms that produce very high precipitation intensities and large accumulations of new snow can produce storm snow avalanches that propagate widely (cleaning out most or all of a start zone) and in some cases can exceed historical avalanche path boundaries.

Smaller storms limit the size of potential storm snow avalanches.

Spatial Distribution and Variability:
Storm snow instabilities are usually more uniform and more widespread than many other types of avalanches. Storm snow instabilities are more common at higher elevations where snowfall intensities and accumulations are greater and may not develop at lower elevations if there is not enough snowfall to create an instability.

Triggering:
During and immediately following peak snowfall intensities, storm snow avalanches often occur naturally or are easily triggered by human and artificial triggers. Remote triggering is possible but not common.

Recognition and Assessment in the Field

Avalanche Activity:
Storm snow avalanches tend to fail on a uniform weak layer, and therefore tend to produce more uniform crown heights than other slabs, such as the telltale lens-shaped crowns associated with wind slabs. Widespread natural storm snow activity is common during periods of intense snowfall, but avalanches continuing for more than 48 hours after snowfall ends likely indicate the presence of a more persistent weak layer.

Snowpack Layering, Tests, and Observations:
Storm snow weak layers are typically thin and have only slight variations in characteristics from the slab above and the bed surface below. As a result they can be extremely difficult to observe directly.

Snowpack tests for storm snow instability should be made within the storm snow itself as well as at the interface between the storm snow and old snow. Standard tests such as the compression test are of limited use in detecting storm snow instability—the new snow is often very soft and compression test columns tend to break apart rather than transmit force to the weak layer and create failure. Tilt tests (tilt board and shovel tilt), ski cutting, or explosive testing on indicator slopes are well suited for assessment of storm snow instabilities. Ski cutting is only advised for shallow storm snow instabilities on small terrain features where no terrain traps exist and the consequences of being caught are low. Storm snow instabilities can sometimes be detected by looking for shooting cracks when walking just above a previously cut ski track.

Surface Conditions:
Any type of new fallen snow or early stage decomposing and fragmented snow grains can be on the surface when storm snow instabilities are present. Because storm snow avalanches occur during and soon after snowfall, the surface condition is generally not one of the older snow grain types such as facets, surface hoar, or melt-freeze grains.

Widespread areas with a feeling of 'upside-down powder' (more cohesive storm snow above softer storm snow) can be an indicator of potential storm snow instability. In many cases, however, the surface snow will be good powder conditions with little indication that a weak layer exists.

Risk Management Strategies

Timing:
Avoid avalanche paths and runouts during and for the first 24-36 hours after periods of intense precipitation.

In some cases, when avalanche activity does not occur during or shortly after the storm, it is possible that storm snow which is initially not cohesive enough to react as a slab may form a slab after a day or two as the upper storm snow settles and gains cohesion. This is common when a relatively cold storm is followed by warming temperatures and/or strong solar radiation.

Human Factors:
The promise of good conditions and the draw of fresh powder may lure people into avalanche terrain too soon after a large storm. While difficult, it is worthwhile to rein in one's desire and lower expectations after a significant snowfall to allow enough time to assess whether storm snow activity is occurring or developing. Waiting for a day or two after a storm can greatly reduce risk when storm snow avalanches are the primary concern.

Terrain
Small, shallow storm snow avalanches can often be managed by ski cutting, but it is not advisable to attempt to ski cut larger, thicker storm snow slabs. In very large storms, be aware that large storm snow avalanches might exceed the historical extent of slide paths, be conservative and maintain an adequate safety margin in the terrain. It is often possible to travel safely where avalanches have already run and no significant reloading has occurred.

Small, low angled, simple terrain is best for the first 24-36 hours after a large storm. Then ease your way into larger terrain if it appears that storm snow activity is not occurring or is tapering off after a day or two. As you work your way into larger slopes, start out by using the most conservative lines on higher ground and near safe areas, such as high points, dense stands of mature timber, etc. In addition, good group management procedures that minimize exposure times and expose only one person at a time are a good bet.

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