INTRODUCTION

While surface hoar formation in our maritime climate is commonplace, conditions do not typically allow for the surface hoar to survive and become buried during a storm event. Our proximity to the ocean brings in approaching storms warm, wet, and with significant wind. Uncommon conditions presented themselves in January 2016 where a cold NW flow developed. These storms came into our area cold, with small amounts of snow, and relatively little wind. Surface hoar layers developed and were subsequently buried on January 5th, January 9th, and January 13. An active avalanche cycle from Jan 5th-Jan19th resulted.

January 13 Forecast Bottom Line and Excerpt:

Considerable avalanche danger with persistent slab problem.

Several layers of concern are present in our current snowpack that have developed over the last week. These buried surface hoar layers exist on NW-N-NE-E-SE aspects in near treeline and below treeline terrain and should be buried anywhere from 4” to 3’ deep. The incoming, wet and heavy storm will put additional stress and weight on these layers which could make them fail today. There is high variability and some uncertainty as to where these layers exist throughout the forecast area. These avalanches have the possibility to propagate large distances, be remotely triggered, and have high consequences.

This is a near treeline and below treeline avalanche problem and is not common for our
area. Any slopes that have buried surface hoar will be suspect. Look for recent avalanche activity, shooting cracks, and whumphing noises. Use careful terrain selection to avoid steep open areas near and below treeline.

January 14 Forecast Bottom Line:

On slopes steeper than 32 degrees, CONSIDERABLE avalanche danger still persists on NW-N-NE-E-SE aspects in near and above treeline terrain due to a combination of wind slabs and persistent slabs. Even though the window for natural avalanches may have passed, human triggered avalanches remain likely. Unusual avalanche conditions exist. Avalanches on steeper slopes could be remotely triggered by a person standing in lower angle terrain. Careful snowpack evaluation, cautious route finding and conservative decision making are essential.


Pro Skier JT Holmes has full burial live recovery while cat skiing in Upper Coldstream Canyon.

"I was skiing a north or northeast aspect in complex terrain with trees, chutes and gullies. I got flushed through, went downhill with the avalanche," Holmes said. "On the fourth or fifth turn, the slope cracked like a spider web and made this sharp, audible noise. I felt the shift instantaneously, this freeing of energy. There was this extreme tension in the slope, and it just broke." JT Holmes

Unfortunately, this story was kept quite and withheld from the public for one week. The story was then released with an interview from the media. At that point, the majority of the buried surface hoar cycle was over.

January 14: Sugar Bowl Ski Resort-Missing skier out of bounds

On Jan 14, after skiing at the ski resort, Carson May left the ski area boundary in the late afternoon. He did not return home that night and was reported missing the next day when he did not show up to work. On Friday, Jan 15, a search was initiated that lasted many days with several agencies participating. Crews searched likely areas near a cell phone ping and along the east Sugar Bowl boundary as well as in bounds at the resort. Search techniques included avalanche dogs, probe teams, Recco searches, and beacon searches. He was not found nor was evidence of his body found. The sheriff's office suspended the search after several days due to avalanche conditions and weather. 6 weeks later on February 29th, his body was found on Donner Summit outside of the Sugar Bowl Ski Resort near Donner Peak buried in avalanche debris at the base of an avalanche path. His body was found by a dog specialized in finding cadavers.

May was reported missing amid near whiteout conditions with a storm that dropped up to 1’ of new snow by the morning of Jan 15. The area had been experiencing unusual avalanche conditions with several layers of buried surface hoar 1 to 3 feet deep in the snowpack that had caused many natural and human triggered avalanches.

6 weeks later on 2/29 when May's body was found. Fig. 1-person in left middle of photo at location of burial. The top of slope was 7740' and the bottom 7600' with a vertical drop of 140'. Slope angles in the starting zone averaged between 38 to 44 degrees in steepness. It is unknown where May entered the slope, but he was found buried at the bottom with skis still on and his head facing up. He had no avalanche rescue equipment. Photo: Steve Reynaud
January 14: Negro Canyon—remotely human triggered buried surface hoar avalanche. 400’ wide x 150’ long, 35 degree slope angle and up to 1m deep slab—Fig. 3. Photo: Logan Talbott

January 15—Forecast Bottom Line:

On slopes steeper than 30 degrees, CONSIDERABLE avalanche danger exists on NW-N-NE-E-SE aspects at all elevations due to a combination of wind slabs and persistent slabs. Large human triggered avalanches are likely and natural avalanches are possible. Unusual avalanche conditions exist. Avalanches on steeper slopes could be remotely triggered by a person standing in lower angle terrain or may be triggered in places traditionally considered safe. Careful snowpack evaluation, cautious route finding and conservative decision making are essential.

January 18: Silver Peak Natural Avalanche. Thought to have occurred on January 17 during storm cycle. Bed surface, crown and debris covered by 10-15cm of storm snow. Observer in photo at crown line, 30 degree average slope angle with 34 degree slope angle at crown. 200’ wide and 150’ long—Fig. 4. Photo Brandon Schwartz

January 27—Avalanche Advisory discussion. Low avalanche danger

What happened to the Deep Persistent Weak Layer?
In early to mid January, up to 3 separate surface hoar layers formed and were buried by subsequent storms on N-NE-E aspects near treeline and below treeline. These buried surface hoar layers are currently buried 1.5 to 4.5 feet deep in the snowpack. A widespread persistent slab avalanche cycle occurred Jan 5 through Jan 19 on these weak layers. Many slopes have been "cleaned out" by already avalanching, or the surface hoar has been collapsed or compressed and has gained strength. Targeted observations and snowpack tests have shown that these layers, in the majority of locations, are no longer reactive and have assimilated into the snowpack. No avalanche activity has been associated with these buried surface hoar layers since Jan 19.

This deep persistent avalanche problem has become unlikely and has been removed as an avalanche problem.

MESSAGING

Messaging was critical to educate our user group on the unusual conditions for our area. Backcountry users in our area get out very quickly post storms and access steep terrain. Avalanche danger in our maritime climate is normally quick to rise and very quick to fall with the bulk of avalanche problems focusing on wind slabs and storm slabs. Our local mountain topography has most of our steeper terrain located toward the upper elevations of our mountains. This helps promote the belief that avalanches only occur at upper elevations in open terrain and that the lower treed terrain is safe. The mythical 24 hour rule is well embedded in our local backcountry community. Also after 4 consecutive winters of well below average snowfall, the winter of '15-'16 produced normal snowfall with accessible terrain that previously had not been possible. Forecasters and staff worked hard to dispel these myths and educate backcountry users on the current avalanche problems and where to avoid them in the terrain.

OUTREACH

Throughout the winter of '15-'16 our education outreach program grew dramatically. The KBYG program helped us get more presenters that could travel throughout our forecast region and do presentations. We also utilized an Avalanche Problem Toolbox presentation that was well received. While more advanced than the KBYG platform, the program focuses on the avalanche problems, where they live, and how to change travel protocols to deal with the specific problem. Many of our presentations were sold out/standing room only events during the mid winter while avalanche conditions were elevated. Many questions during and after the event focused on the surface hoar event or the current avalanche problems.

Local media showed a large interest in the avalanche center for this winter. Forecasters all did several interviews per week with the many local media outlets as well as larger regional outlets during this buried surface hoar event and throughout the winter. The forecast bottom line was also read each morning throughout the winter season on the local radio station - KTKE 101.5 based out of Truckee, CA.

January 15, 2016- Sierra Sun

“There could be avalanches in places that have never seen avalanches before,” said Brandon Schwartz, lead forecaster for the center. The biggest contributor to unstable conditions is buried surface hoar which leads to persistent slabs. Schwartz said in the past 12 seasons widespread buried surface hoar conditions have only occurred three times. This season it’s already happened four times. In the Sierra Nevada it's much more common to encounter
avalanche problems related to storm and wind loaded snow."

Schwartz said the reason it’s important to be aware of the condition is because it’s so unusual for the Sierra Nevada.

Backcountry clearings below treeline, which are often the types of places skiers, snowboarders and snowmobilers love to ride, are where the persistent slabs are forming.

“The backcountry public needs to approach differently and manage terrain differently when dealing with this type of weak layer,” Schwartz said.

January 21, 2016: Reno Gazette Journal

"Typically, in the Sierra Nevada when surface hoar forms it’s broken down by warm temperatures or high winds before getting buried. Buried surface hoar, unlike wind and storm slabs which are more common to the region, has a tendency to form persistent weak layers that contribute to avalanches that are difficult to predict."

“Unfortunately, determining which slopes the buried surface hoar does exist on is difficult,” forecaster Andy Anderson wrote. He continued, “Recent avalanche activity, shooting cracks, collapsing, whumphing and snowpit tests can provide some clues, but sometimes the first clue is an avalanche triggered by the party on the slope.” Sierra Avalanche Center Forecaster Andy Anderson.

GETTING THE MESSAGE

Many newer backcountry users are getting the message that education is valuable and are taking level 1 avalanche courses. Many who have taken avalanche courses over 5+ years ago have not been formally exposed to the avalanche problems and may not be as familiar with them and their use. There is also a segment of sidecountry skiers-or skiers who enter the backcountry from ski resorts. These users range greatly in experience and education. Many are on fixed heel alpine gear or snowboards with no avalanche rescue gear and little to no education. With the majority being younger and more transient in the community, this group has been the hardest to reach and/or provide outreach to.

In our forecast region we have several ski resorts with open boundaries that allow access onto public lands. Different land use policies exist at different ski resort and some resorts are not on Forest Service land. Some of these ski resorts now have guide companies with sidecountry ski programs running in the resort to provide some education to their users. Others are posting the daily avalanche advisory at the top of chairlifts that are key exit points into the backcountry. There is also talk of adding transceiver checks at the exit points as well. Although, these efforts are not commonplace at every ski resort and there are no set standards.

We need to encourage the further push for more information and education coming from where these users access the backcountry from. This partnership with the ski resorts is a very important part of reaching this user group. For the future, we need to come up with more ways to partner with these ski resorts and ski patrols to help educate people who venture into the backcountry.

CONCLUSION

Considerable efforts were made on messaging with our avalanche forecasts throughout this specific buried surface hoar event. Accompanied with the education outreach program we were able to reach a variety of user groups and inform them on current conditions. With the help from the media and continued commitment to social media we were able to reach many in the local backcountry community as well as many visiting users that frequent our mountain terrain. Outreach education to our many user groups about how to use our forecast products and trying to reach user groups that we may not be reaching remain continuing future goals.

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