Snowpack tug-of-war

Submitted by Mark Staples on Thu, 01/02/2025 - 10:07

Right now it's a tricky balance, and it's hard to say if the snowpack is stable or unstable. More snow is making it unstable but will also help it become strong and stable in the future. The notes below come from discussions and thoughts we've been having about the snowpack.

Some background info:

- Early snow left us with 1-2 feet of snow on the ground by Thanksgiving.
- Dry, clear weather created facets between Thanksgiving and mid-December. In many places surface hoar crystals grew on the snow surface. Despite the warm weather during that time, clear skies allowed the snow to be much colder than air temperatures. Our video from Dec 2 explains this process and this video from Dec 3 shows it.
- Light snowfall from mid-December buried and preserved this weak layer and in some places the surface hoar crystals survived and were buried as well. Dave shows how this weak layer was buried on Dec 15th in this video.
- Snowfall "turned on" around Christmas through New Years and is forecasted to continue through the first weekend of January.
- Winds have not blown much since Dec 29th - meaning there is a lot of powder ready to be blown around.

The current situation:

- The weak layer generally has 1.5-3 feet of snow (4-5 inches of water) on top of it.
- There was some avalanche activity around Christmas and New Years. HOWEVER, poor visibility and snowy weather has prevented us from seeing many slides.

Where does this leave us?

It is a tale of two snowpacks. Back in early December, areas with deeper snow formed facets only at the snow surface, and this layer has gained some strength. In contrast, the entire snowpack faceted in areas where it was thinner and has not gained strength. Alex explains the difference in this video from Dec 6th.

Areas with deeper snow (more than 3 feet)

Snow was deeper in these areas during the early December dry period when clear skies allowed the snow surface to get much much colder than air temperatures, mostly at night. This created facets on the snow surface.

Compare the two snowpit profiles from Sawtelle Peak near Island Park (individual profiles attached as well as an image of them side by side). They are from the same location, but one is on Dec 17 when the weak layer was first buried shown in this video, and one is on Dec 31. If you aren't familiar with interpreting profiles, there are three things to notice.

1. The weak layer has gained some hardness (Fist to 4 fingers- hardness) and strength. It took 3 taps to break and propagate an ECT in the Dec 17 pit (ECTP3). It took 24 taps to break and propagate an ECT in the Dec 31 pit (ECTP24). We also got a collapse when approaching the site the second time - so a higher test score didn't mean stability.
2. The weak layer has compressed from 20 cm to about 10 cm thick.
3. There is a much more cohesive slab above the weak layer in the Dec 31 pit. This thick layer of snow is needed for the weak layer to start healing in the long term, but it also means that avalanches on that layer in the short term will be bigger.

I suspect we'd see similar situations in places like the Bridger Range which was slammed by a 3-day storm with 3 feet of snow (2.45" water) over New Year's. Watch Dave's video from the Bridgers on Dec 31. In upper Hyalite Canyon on Dec 27, Dave and Mark found a location where the weak layer was starting to heal as Dave explains in this video.

Areas with thinner snow (less than 3 feet)

In these places, the entire bottom part of the snowpack is faceted and will take much longer to gain strength. Stepping out of your skis or off your sled will cause you to immediately sink to the ground. Ian skied in one of these areas near Hebgen Lake on January 1st (see attached Trapper Creek profile and notice the shallow total snow depth of 65 cm or 2 ft), and Ian and Alex rode on Lionhead on Dec 27 finding similarly weak snow.

What does the future hold?

It's a tug-of-war now. More snow is needed to bury and insulate these weak layers as well as preventing new ones from forming. Too much snow raises the avalanche danger in the short term, but with time it helps the weak layers heal. It is far from being the worst weak layer we've seen with good prospects for healing. However, we're not "over the hump" just yet. Persistent slab (PS) avalanches will still happen and likely grow larger before the situation improves. It has to get worse before it gets better.

Eventually, the odds of triggering a PS avalanche will go down a lot (they won't be zero for a decent chunk of time though), and then we'll mostly focus on avalanche problems in new snow or wind-blown snow alone.

The two wild cards:

(1) Between Dec 31 and Jan 2, **WINDS** hadn't blown too much and transported much snow. This is why there's so much soft powder and great skiing and riding conditions. Widespread avalanche cycles are often preceded by major wind events. Wind can load a slope 10 times faster than snow falling from the sky. A wind event near Cooke City caused some large avalanches Alex describes in this video from Dec 20th. Watch out if winds ramp up again!

(2) Even if the weak layer heals, a **LARGE ENOUGH STORM** could wake it up. Some of the largest avalanches happen with a strong snowpack which allows a lot of snow to pile up before it avalanches. Weak snowpacks just can't hold enough snow to create massive avalanches. SO - it may never come, but watch out for a very large storm with inches of water plus high winds.

What am I doing?

I'm staying out of avalanche terrain and riding slopes less than 30 degrees in steepness. The snow is riding great on those slopes. There's too much uncertainty for me to take a chance just yet. Karl Birkeland used to say that the "line is blurry at best. If you hang out too close to the line, one day you'll end up on the wrong side." I want to stay on the right side so that I'm ready to hit it when the green light comes on. Maybe that'll be this season, maybe not...I can wait.

Stay safe out there and play the long game