DOES IT ALWAYS SNOW IN JULY, OR RAIN IN DECEMBER? MELT-FREEZE RECRYSTALLIZATION IN THE MIDST OF A RECORD SETTING SEASON

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ABSTRACT: The winter of 2025-2026 set records for below average snowfall. Compared to the winter of 2022-2023, which set records for above average snowfall, one would think the similarities would be few and far between. However, mid-storm crusts and near-surface facets are not in tune with seasonal averages. In early April 2026 we observed a late-season mid-storm melt-layer recrystallization event. In this paper we will discuss how this layer formed, was identified, and preserved, as well as the response that public forecasters took and could take in the future to communicate avalanche hazard from snow and weather events that are not observed in the Central Wasatch on a regular basis.

KEYWORDS: Snowpack Properties, Avalanche Forecasting, Risk Communication, Melt-Layer Recrystallization, Crusts

1. FORMATION, IDENTIFICATION, AND PRESERVATION

On April 1, 2026 a storm began in the Central Wasatch Mountains located in Northern Utah just to the east of Salt Lake City. The storm started with approximately 15cm (6”) of snow with 15mm (.6”) SWE (snow water equivalent) followed by a short break when the sun briefly appeared out of the clouds and heated the surface snow, creating a melt layer (McClung and Schaerer 2006) (all snow and weather measurements in this paper taken from Collins Study Plot located at Alta Ski Area in Little Cottonwood Canyon 2945m (9,662’).

In the midst of this green-housing event, Utah Avalanche Center Forecaster (UAC) Drew Hardesty and I identified surface snow that was in the melt stage of a melt-freeze layer. We observed this melt-layer on a northerly facing slope in upper Big Cottonwood Canyon at an elevation of 3200m (10,500’). We hypothesized that with forecasted dropping temperatures that this melt layer might freeze and develop a layer of near-surface facets that would then be preserved by incoming snowfall.

Melt-layer recrystallization can be difficult to identify in the field using thermometers, however if the environmental factors leading to the formation of this layer are known, it can be identified in the field by practitioners, operational forecasters, and the general public (Birkeland 2025).

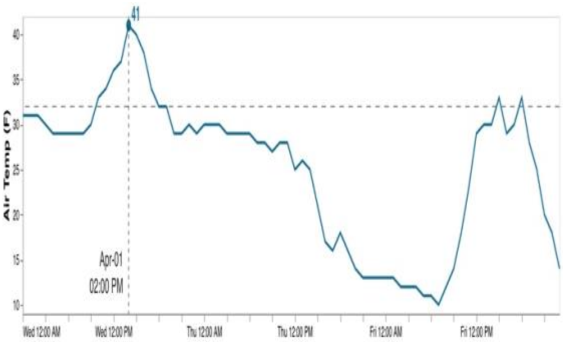

Figure 1: Hourly Temperature °F Collins Study Plot Wednesday April 1-Friday April 3, 2026. Dashed black line shows high temperature of 5°C (41°F)

As the next stage of the storm moved through and temperatures dropped (Figure 1), the melt-layer froze and an incredibly strong temperature gradient likely led to the formation of near-surface facets above the crust (Birkeland 1998). These facets were then preserved by an additional 41-76cm (16”-30”) snow and 38-63mm (1.5”-2.5”) SWE (Figure 2). By the morning of April 3 under partly cloudy skies backcountry travelers throughout the region were leaving trailheads to enjoy one of the softest snow days of the season, in a season that had been notably short of soft snow days.

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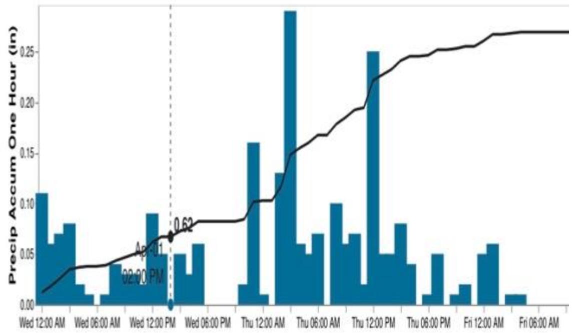

Figure 1: Hourly precipitation accumulation from Collins Study Plot Wednesday April 1-Friday April 3, 2026. Dashed black line shows break in storm when melt-freeze layer likely formed.

2. HYPOTHESIS

Our hypothesis is that this melt-layer with near-surface facets above it was buried and created a weak interface resulting in a number of human-triggered avalanches in the backcountry and during mitigation at ski-area operations. Without having a chance to physically look at all of the publicly-reported crown faces and bed surfaces, there is a chance that the avalanches did not all fail at the same interface, but the similarities show that it is more likely than not.

This hypothesis is based on the weak layer being elevated approximately 10- 20cm (4”-8”) off of the old snow surface (March 31 interface). Crown face depths above the melt layer were 15-63cm (6”- 2.5’) and would be consistent with storm totals; factoring for aspect, elevation, favored drainages, settlement, and wind deposited snow.

Figure 3: This avalanche was on a northeast facing slope at 3094m (10,150’). The crown was approximately 36-46cm (14”-18”) deep and 30m (100’ wide). The bed surface was buried near-surface facets above a melt-freeze crust. Avalanche occurred April 3, 2026.

While we cannot say with certainty that the melt-freeze layer with buried near-surface facets was the culprit in all of these avalanches we make an assumption based off of similarities to the avalanches we did look at which showed an elevated bed surface with storm snow underneath and near-surface facets above a frozen melt-freeze crust (Figure 6).

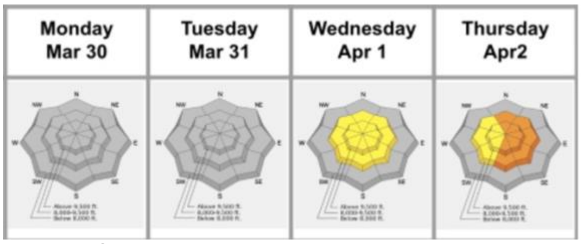

Figure 4: Salt Lake Avalanche Forecast rose in the days leading up to this avalanche cycle. March 30-April 2, 2026.

Figure 5: Photo showing bed surface of buried near-surface facets above a melt-freeze crust on a north facing slope at 3193m (10,475’). This avalanche was 20- 46cm (8”-18”) deep and 145m (50’) wide. Avalanche occurred on April 6, 2026.

Figure 6: Photo showing bed surface made up of buried near-surface facets above a thin melt-freeze crust from Figure 5 avalanche.

3. AVALANCHE CYCLE

Starting on April 2, 2026 the UAC received a number of avalanche observations primarily from the Central Wasatch, on most aspects and elevations above 2835m (9,300') (Figure 7). This avalanche cycle continued until April 7 with the UAC recording over thirty backcountry avalanches from the Salt Lake and Provo Region with fourteen people caught and carried and two reported injuries. We believe that the majority of these avalanches likely failed on the now buried near-surface facets above the melt-layer which was in a frozen state (melt-layer recrystallization).

This was primarily a mid and high elevation problem due to lack of snow in lower elevation terrain. The danger rose from the days leading up to this cycle was grayed out, showing a lack of snow and avalanche hazard in lower elevation terrain (Figure 4).

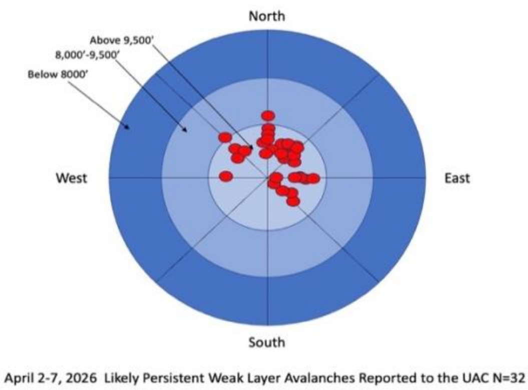

Figure 7: Avalanche heat map showing location and elevation of avalanches likely to have failed at the melt-layer recrystallization interface in the Salt Lake and Provo forecast regions from April 2-7, 2026 . Corresponding elevations in meters; 8000'/2438m, 9,500'/2895m.

The morning of Friday, April 3 dawned with cold temperatures, partly cloudy skies, and spectacular surface conditions. Air temperature (Figure 1) through the day warmed from -12°C (10°F) to 0.5°C (33°F) (Figure 1) and local forecasters noted green-housing (Steenburg 2017) that timed with avalanche activity in ski area boundaries. During the period of cold temperatures, ski area operations reported minimal results with explosive mitigation, however once the ambient air temperature warmed up there were a number of patroller-triggered avalanches on mitigation routes (J. Kelly, pers. comm. 2026).

For a general public that had been starved of soft snow most of the season, this was the weekend the desire kicked in. The UAC began elevating the avalanche danger on the morning of April 2 and by April 3 the forecast was CONSIDERABLE (Figure 4) for wind-drifted and new snow avalanches with a specific mention about the intersection of danger and desire (Figure 9).

New snow likely played a factor in the avalanche cycle; in retrospect we believe that melt-layer recrystallization was a bigger player than was communicated to the general public. The bulk of the avalanche activity occurred on April 3, the first day of clearing after the storm (Figure 8) with ski area operations reporting avalanche activity on this interface in their operational terrain as early as April 3 continuing until April 7.

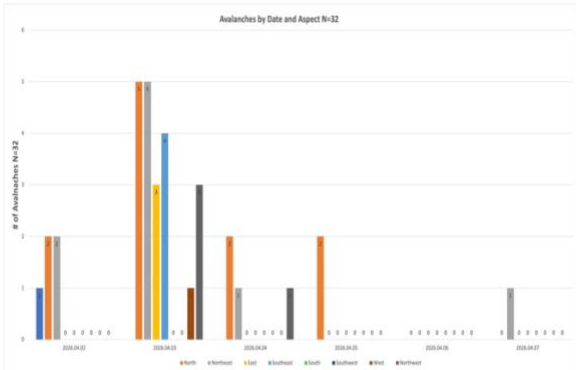

Figure 8: Backcountry avalanches reported to the UAC that were identified as soft slab and likely to have failed on melt-freeze recrystallization layer by aspect April 2-7, 2026 in the Salt Lake, Ogden, and Provo forecast regions N=32.

4. CHALLENGES

Previous research completed on late season persistent weak layer (PWL) avalanches mentions forecasters having reluctance to add PWL problems or increase avalanche danger in the spring. This can lead to a slow or inappropriate mindset adjustment and allow both the forecasters and the public to misinterpret and misidentify avalanche problems leading to close calls (Johnson and Reardon 2023).

This melt-freeze recrystallization layer developed very quickly in a brief window of warm and cloudy conditions and was preserved by the continuation of the storm. It can be easy to miss this type of problem because it can be short-lived and in the case of a spring PWL it can be overshadowed at the onset by storm snow and by the wet snow problem shortly following the storm. The widespread warm and cloudy conditions that occurred mid-storm, likely contributed to the formation of this melt layer (Figure 1).

Forecaster fatigue can set in by the end of the season. Whether that is physical fatigue, mental fatigue, or the mindset that certain problems shouldn't occur out of their ideal timeframe. One of the challenges that we face is adapting to a changing environment. We can learn from avalanche cycles, both past and present. This in turn will allow us to adjust and tailor our communication and our own decision making when confronted with something that doesn't fit past patterns.

5. LESSONS LEARNED

A number of the avalanches reported to the UAC during this cycle involved experienced backcountry travelers, professional snow workers, educators, and off-duty ski patrollers. This is similar to the findings from Johnson and Reardon (2023) "April Fooled in the Flathead" involving professional snow workers. In our case we hypothesize that the record low snow year coupled with a late season PWL could have been one of the factors that led to more involvements in this avalanche cycle. The desire for fresh snow was strong.

The avalanche forecast did discuss the intersection of desire with danger (Figure 9), and at the time the desire/danger graph communicated rising hazard to the public based on increasing avalanche danger and public desire for fresh turns.

While the Utah Avalanche Center's bottom line avalanche danger and strong wording conveyed the big picture, we did not adequately capture and warn of the "nature" of the avalanche problem. This may have best relayed the tricky and unpredictable nature and added extra "WARNING" to the educated backcountry user.

As forecasters we could more quickly recognize and communicate PWL problems regardless of how short lived they may be or whether it has traditionally been an appropriate time of year to have that problem. Professionally this could be accomplished by using the existing UAC InfoEx which is available to the local professional avalanche community as an exchange of snow, avalanche, and weather observations, and an ideal place to note unusual conditions or observations.

We could take steps toward better isolating and communicating avalanche problems to the general public, particularly to our more experienced users. If we have learned anything over the years it is that the only constant with the weather is that it will change; and anyone who has been snowed on in July or rained on over the Christmas holidays can vouch for this.

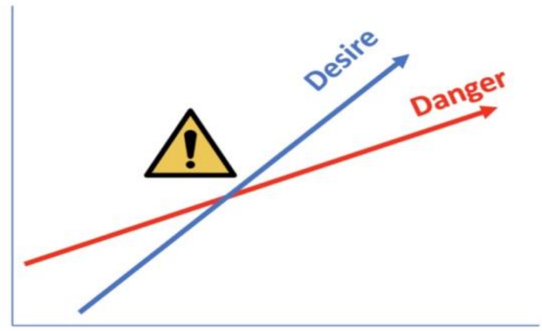

Figure 9: Graph used in UAC avalanche forecast discussing potential for increased avalanche involvements at the intersection of danger and desire. Used on the Salt Lake Region forecast April 3-4, 2026.

6. FURTHER RESEARCH

This research stems from field observations showing weak layer formation followed by an avalanche cycle. Further research could be focused on looking at past seasons (UAC 2020 and Johnson, Greene 2002) when a melt-layer recrystallization may have been the culprit in avalanche cycles. In April 2020 over 40 avalanches were triggered and a melt-layer recrystallization layer was likely involved. This type of weak layer may start to impact our intermountain snowpack more frequently as we note warming temperatures (Hotaling 2024).

We found similarities to a case study from Kelly and Staples (2023) that looked at a radiation recrystallization (RR) event that occurred, was quickly buried, and caught a number of experienced backcountry users off guard. While both the 2023 and 2026 seasons set record snowfall amounts for very different reasons. In both seasons, we found quick forming, preserved weak layers that led to a short-lived avalanche cycle.

The forecasters at the UAC did discuss the potential for avalanche involvements increasing at the intersection of desire and danger (Figure 9) and perhaps this could be an avenue to further explore communication with the public through the use of this graph.

Communicating with the public is an ongoing challenge and work has been done to better gauge how accurately we communicate avalanche problems to the general public (Champion et al. 2023). Further research could look at the effectiveness of communicating specific quick forming avalanche problems, such as this one, compared with forecasting for increasing danger and general avalanche awareness.

As always direct field observations and time on snow is the best way to identify the formation and preservation of these layers of recrystallized snow.

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