

2012/2013 Snowpack Summary Archive

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[Agassiz Peak Station \(APS\)](#) at 11500'
[Snowslide Canyon Snotel \(SCS\)](#) at 9730'

Friday, March 22, 2013

The Weeks Weather in Review

High pressure continued to dominate for the second week in a row. Temperatures have been above average to average over the past seven days. Intermittent breezy afternoons and partly cloudy skies have accompanied the passing of storms to our north, but local precipitation has been limited to a few short showers. Below freezing nighttime cooling has helped to solidify last week's wet snowpack and spring conditions seem here to stay.

Summary

On most aspects and elevations near isothermal conditions have developed. The exception is on northern shaded slopes at high elevation where persistent faceted crystals are still quite evident, although they are quickly bonding together. In an 'isothermal snowpack', temperatures are close to 0 degrees C through the entire snow profile.

Under these conditions, the snowpack will continue to strengthen and gain density as long as the current melt/freeze diurnal cycle continues. This maturing process will eventually cause existing weak layers to disappear, making chances of delayed action avalanches (those occurring more than a day after a major storm or wind event) unlikely within the current snowpack.

Looking into the future:

If we get another significant storm or two before the snowpack melts, we may have some storm snow concerns. This will probably be short-lived, with stability regained within a day or so of the event as new snow bonds to old. Without new snow, and with available snow for transport minimal, wind slab formation is unlikely. Even during breezy conditions over the past few days, very little snow has moved.

As we officially move into spring, backcountry travelers should be aware of excessive warm spells, particularly when nighttime low temperatures at high elevation stay above freezing for several nights in a row. Loss of strength in the snowpack due to the melting of bonds between grains can still potentially produce massive wet slides, especially on warm afternoons and south facing terrain.

Springtime "rain on snow" can create a similar loss of snowpack strength and also create wet slide problems. Generally more than an inch of rain must fall to cause this to occur. Intense springtime rain storms at high elevation are relatively rare in our region, but not unheard of.

This week's summary will conclude our weekly posting for the 2012-13 winter. Updates will be posted if any notable or unusual observations are recorded, or after a significant precipitation event.

The Kachina Peaks Avalanche Center hopes these summaries have been informative and educational. This has been a pilot project for KPAC and as such there is plenty of room for improvement. We have learned a lot from this process and will evaluate possible changes and improvements.

Please submit feedback and suggestions on ways to enhance the usefulness and relevance of the summaries and to consider the format and frequency of postings. A 'summary survey' may be posted to the website and your participation is encouraged. Regardless, we would love to hear what locals think, how we can serve your needs better and ultimately fulfill our mission of promoting snow safety on the Peaks. Send your input to info@kachinapeaks.org.

Have a wonderful spring and summer, keep in touch, and many thanks for your support! It's been a great winter...

Friday, March 15, 2013

The Weeks Weather in Review

Last Saturday's 23 inch snow storm (recorded at 10,800') was followed by north winds which redistributed much of the new snow on Sunday March 10th. Since then a ridge of high pressure has built over the region bringing with it near record breaking warm conditions and very little wind. On Wednesday night the low temperature recorded at the Agassiz station at 11500 feet was 36 degrees F and the high temperature on Thursday was 49 degrees.

Cooler conditions are forecasted for this weekend, however, high pressure and above average maximum temperatures are expected to return next week.

Summary

The high density storm snow combined with warm spring temperatures have resulted in rapid bonding of the storm snow to the snowpack underneath. For the most part, threshold temperature gradients for kinetic metamorphism throughout the entire snowpack are absent and facets are slowly bonding together rather than developing further.

Even the recently observed near surface facets are much less of a concern than previously described. Some hard wind slab still exists in widely distributed pockets, but recent strength tests demonstrate that bonding has progressed. However, avoid and retreat from wind loaded terrain with hollow sounding slabs, any 'whumpfing' activity, shooting cracks or propagating fractures.



Our primary concern for the week is the possibility of wet snow avalanches. Unprecedented warming is creating the potential for both wet slab and wet loose snow avalanches. Of particular concern are the above freezing minimum temperatures that have been recorded at high elevation for the last few evenings.

Wet snow avalanches are relatively rare on San Francisco Peaks due to our usual diurnal temperature fluctuations that typically lock the snowpack together at night when high elevation freezing is customary. However, recently anomalous conditions have occurred and nighttime stabilization has not taken place.

On southern aspects, wet snow instabilities have been observed in the form of snow rollerballs and pinwheels of a variety of sizes. Some massive snow rollers and wet activity instabilities have been initiated by skiers during this recent warm cycle as well as small to moderate sized point releases from sun absorbing rock outcrops. On Wednesday and Thursday, some giant snow rollerballs reached impressive sizes, equivalent to several refrigerators slowly tumbling down the slope.

Fortunately, these have been in the form of loose wet snow avalanches and have not gained the mass of slab releases. Still, backcountry travelers should be aware of the potential problem, particularly on southern, southeastern and southwestern slopes. Be wary of sunbaked slopes, particularly when they become too sloppy and your snowboard, skis or boot pack are sinking deep into the goo. Slush like snow packs have lost cohesion, creating wet slab failure conditions. Wet slab avalanches are difficult to predict and are thus worthy of extra caution.

Remember these conditions have been found surprisingly early in the day, as night time freezing has not occurred the last two evenings. Wet avalanches move slowly, and because of their mass and high density, they are particularly dangerous if one becomes completely buried. Breathing is not possible in this type of saturated snow, so death comes quickly making companion rescue less effective.

The good news is, a slight cooling trend is forecast for the weekend. This may help to resolve this potential wet avalanche concern by dishing up a more typical freeze/thaw cycle and hopefully initiating a wonderful corn snow season of safe and blissful backcountry skiing.

Spring skiing, also referred to as corn skiing, is all about adequate freezing at night and proper timing of your tour. Plan early and intend to be clear of avalanche slopes before they are warmed

to the point of saturation. This window of opportunity is often short, and can occur before noon on direct south facing terrain. Check the depth of the freeze as you tour, as this will vary with elevation, aspect and the duration of the previous evenings freezing temperatures.

Enjoy the spring skiing and please report your observations and adventures [here!](#)

Join KPAC staff for a field day of snow study on the Peaks, Saturday March 16, 9:00 a.m. – 12:00, at the base of the Agassiz lift. Lift access generously provided by the Arizona Snowbowl.

Friday, March 8, 2013

The Weeks Weather in Review

The previous week truly felt like spring was knocking on the door, with high and dry conditions prevailing. Winds were mostly moderate (15-25 mph) and most recently out of the south and southwest. A freeze thaw pattern set up on elevations below 10500 ft with diurnal fluctuations of 15-33 degrees F at most locations. The snowpack is becoming isothermal (losing all temperature gradient) on warmer aspects below 9000 ft and on wind striped aspects where solar gain from exposed rocks is contributing to rapid ablation.

This is changing as a Pacific storm arrives today, bringing dramatically cooler temperatures, windy conditions (25-40 mph out of the Southwest) and 15 to 26 inches of snow. Loading will be significant, as the new snow will have approximately 2 inches of Snow Water Equivalent (SWE). Snowfall accumulation is likely to exceed one inch per hour for prolonged periods of time.

Summary

Over the past week, the snowpack has lost most of its reactivity. Wind slabs have bonded sufficiently to the snowpack beneath to make the likelihood of ski-triggered avalanches relatively low, without the addition of new snow. Compression test results have indicated good strength (CT20-30 and low fracture propagation energy with Q3- Q2 shears and no fracture propagation using Extended Column Tests (ECTN). On breezy days, very little snow has transported, since what snow remains at high elevation is locked in as a slab and unavailable to move. Pockets of unstable wind slab or persistent slab may still be hiding out there, but so far they have eluded our observers.

Of greater concern is fairly widespread near-surface faceting that is developing at high elevation (above tree line) where snow remains. The snowpack has lost significant temperature gradient in the bottom layers. In this segment, bonding and rounding, even of well-developed depth hoar, is beginning to dominate. In the upper snowpack, however, dramatic temperature gradients are still present. In some snow pits, differences of as much as 6 degrees C within a 10 cm segment have been measured. In most cases, this thin, reactive weak layer (consisting of .5 to 1.5 mm near surface facets) is found less than 15 centimeters below the snow surface, so insufficient slab

above the weak layer exists to cause concern at the moment.



With the arrival of a major Pacific storm concurrent with the timing of the posting of our summary, conditions may change rapidly. One possible scenario is that a new storm snow avalanche problem may develop rapidly over the next 48 hours. This could occur by loading the near-surface facets layer to its failure threshold, and by supplying the added mass to make the slab dangerous and capable of burying someone. Additionally, new snow will take time to bond to the old snow surfaces, many of which are hard crusts or wind slab.



The storm will be accompanied with strong wind out of the southwest, potentially causing significant wind loading and wind slab formation. Post-storm wind out of the north, which we have become quite accustomed to, is also forecast for the days following the main precipitation event, potentially causing further wind slab development on a variety of aspects. Overall, wind loading during the storm will be on northeast-facing slopes and northeast-facing flanks of gullies. Post-storm loading will be on more southerly aspects.

By Wednesday, March 13th, temperatures are forecast to reach 37 deg. F near treeline. Watch for instabilities created by rapid warming. Instabilities were [noted](#) during the warming event last weekend.

Backcountry travelers are urged to heighten their awareness of signs of instability such as whomping and cracking of the snowpack while traveling in undisturbed snow, witnessed natural or human triggered avalanches (even small slab avalanche that may travel less than 100 feet) and signs of wind-transported snow. This includes plumes of blowing snow along ridge tops, pillowed or loaded slabs on lee sides of ridges, along gully flanks and downwind of trees islands.

As always, be careful out there, travel one at a time in suspected avalanche zones and report all signs of instability and avalanche occurrences on our [public observation/discussion boards](#).

Come support KPAC's mission of public avalanche education and safety training by attending The Mikee Linville Backcountry Awareness Scholarship Fundraiser. The event will be hosted in the historic Monte Vista Hotel in Flagstaff starting at 5 pm on Saturday March 9th. Features include: Uncle Buzz's gourmet dinner for a donation of \$15, an array of live music, raffle, a silent auction and drink specials. Come join the fun and help raise scholarship funds to enable local participation in avalanche safety education and training. Event [FLYER](#).

Friday, March 1, 2013

The Weeks Weather in Review

Our last snowfall occurred from early morning Wednesday, February 20th through Sunday, February 24th. During this period, Arizona Snowbowl recorded 22" of low density, new snow at 10800'. The Snowslide Canyon SnoTel site struggled with accurately measuring the low-density snow and reported a total of ~1/2" or more of snow water equivalent (SWE).

Winds were relatively light during the precipitation event, but post storm northerly winds have been strong at high to mid elevations, particularly on February 26th when sustained velocities of over 50 mph out of the north, northwest and northeast were recorded. Between February 22nd and 28th temperatures were slightly cooler than seasonal averages for this time of year. The Agassiz Peak station reported temperatures between -4 and 28 degrees F at 11,500 ft. Starting on Saturday March 2nd a warming trend is forecasted for the region. The current tree line forecast pushes daytime temperatures above freezing for the next few days.

Summary

The San Francisco Peaks snowpack continues to gain strength as post storm high pressure sets in. A transition toward isothermal spring-like conditions is taking place, as is evident from moderating temperature gradients in the lower 50 centimeters of the snowpack in most locations. This is clear from temperature profiles recorded on a variety of aspects and elevations. Even on north facing slopes at 10,400 feet, temperature gradients have abated, resulting in a lack of faceted crystal or depth hoar growth in the basal snowpack.

An average temperature gradient of at least 1 degree Celcius per 10 cm in the snowpack is required to promote faceted growth. Gradients of less than 1 degree C/ 10cm promote equilibrium metamorphism, or rounding, which generally strengthens bonds between grains. However, localized gradients occurring near crust layers can promote faceting in the upper portions of the snowpack.



Pockets of sensitive wind slab are present on a variety of aspects and elevations. Unlike the bottom half of the snowpack, the top half shows significant temperature gradients at higher elevations. Our snow pit investigations show sufficient temperature gradients to produce near surface facets in the top 30-40 centimeters of the snowpack.

Near surface facets have been recently observed on various aspects at elevations above 10,000 feet, often in association with wind or sun crusts. Such a sandwich can be a vicious mix since this combination furnishes both a smooth bed surface and a layer that may fail under load. So far we have found few examples of these weaknesses reacting to human triggers or producing alarming test results. However, with the recent additions of wind-transported snow that is now a moderately thick slab, or a succession of thin slabs, these conditions may provide the missing ingredient.



Wind slab sitting on a persistent weak layer (as described above) can potentially produce persistent slab avalanche conditions with hazards that can linger for an extended time. It is unlikely that these conditions are widespread. Recently, observers in the Inner Basin found

highly variable distribution of wind affected snow. Within as little as 30 meters of travel they encountered the full range of conditions from sastrugi, to wind crust to bulletproof hard slab. Hard slab overlying a near surface faceted/crust combination is a condition to look for and avoid.

Generally, the snowpack structure is still quite weak, but thankfully very little propagation energy has been observed. Extended Column Tests (ECT) and Propagation Saw Tests (PST) have not succeeded in producing fracture propagation. The one exception is where newly formed hard wind slab is overlaying a persistent weakness or where the slab hasn't bonded to the snowpack below.

Once again, avoiding hard slabs that have a hollow or drum-like sound when travelled upon is the safest practice. Slab strengths are highly variable for a variety of reasons, but often because of their uneven thickness across a slope. A skier or boarder can trigger a slab avalanche by inadvertently crossing a sensitive trigger point, where the slab happens to be thinner and therefore weaker. Unfortunately such trigger points are invisible from above the surface, so staying off the slab is the best advice. Sensitive slabs may become even more sensitive in the short term with the warming temperature trend forecasted for the weekend.

Please keep in mind that our surveys are always limited and cannot cover all aspects and elevations on the San Francisco Peaks. Recent wind events have redistributed snow erratically, so characterizing instability by aspect and elevation has been even more challenging than usual.

Safe travels and please continue submitting your observations and adventures. Join KPAC next weekend, Saturday March 9, at the Monte Vista Lounge, for the 3rd Annual Mikee Linville Scholarship Fundraiser, starting at 5:00 pm. Amazing food, raffle items and live music provided! More [information](#).

Friday, February 22, 2013

The Weeks Weather in Review

The week began with high pressure dominating the region and unseasonably warm temperatures. On Saturday the 16th, the temperature spiked to a high of 37 degrees F at 11,500', adding significant midday heat to the snowpack. A surface melt-freeze crust was abruptly formed on most non-shaded slopes to nearly 12,000 feet.

Southern slopes above tree line, developed significant temperature gradients leading to the formation of tiny facets below the wet surface snow, where it interfaced with the colder

snowpack below. Once refrozen the result was a thin crust/facet sandwich. This condition was observed in pits dug in the South-side starting zones at 11,700 feet and could become a significant yet subtle weak layer.

Wednesday morning brought a pronounced change in the weather as several cold storms migrated through our region, initially disappointing locals as most of the energy tracked south of the Mogollon Rim. However, subsequent precipitation added 12-23 inches of very low density snow, with a Snow Water Equivalent (SWE) of ~1/2 inch at the Snowslide SnoTel site at 9730 feet. Prior to today, winds remained moderate, minimizing transport of the available low density snow. Strong north and northwest winds Thursday night and Friday(today) have since transported substantial amounts of snow along the ridge tops to south through southeast aspects. There is also cross loading of lower elevation terrain features.

Summary



Due to the absence of strong wind during the recent storm, slab formation on typical storm leeward slopes (northeast and east facing) are less of a concern. However, some small pockets of soft slab have been observed above tree line on these aspects. Winds today cranked up, reaching speeds of 30-40 mph from the north and northwest and along ridge tops.

Winds are expected to continue, shift to westerlies and reach their maximums Saturday and Saturday evening. Wind transported snow may become denser, leading to the development of dangerous wind slabs on southern, southeastern and even east facing slopes above treeline and also on gully flanks of these same aspects due to cross loading. Remember, wind speeds of between 20 and 50 mph transport significant quantities of snow, with velocities of 25-35 mph being optimal. The light new snow will be particularly susceptible to movement even with relatively low velocity wind.

Watch leeward slopes for loading and treat wind slabs with caution. A hard slab may support your weight initially, but fracture when a rider is farther out onto the slope. Sustained loading can add significant weight to weak layers buried lower in the snowpack. Seek out and test safe, representative slopes for fracturing, shooting cracks, and hollow 'whumpfing' sounds.



In most areas investigated, storm snow has bonded fairly well to layers below. The exceptions are where new snow lays on previously developed hard slab, sun and wind crusts. In these areas bonding was initially poor, but should improve fairly quickly. Allowing the new snow time to adhere to the snowpack below will reduce the probability of human triggered avalanches. Sun exposed slopes above 11,000' developed a crust last week which is now buried under the new snow. As mentioned previously, a micro thin layer of facets has developed below this crust. This layer has not proven overly reactive in our test pits (no propagation on an ECT – extended column test), however, this layer may become more reactive with increased weight from wind loading snow. Travelers on these slopes should exercise considerable caution and evaluate each slope individually.

As above tree line terrain becomes wind affected by scouring and slab formation, consider transitioning travel to below tree line, seeking wind and sun protected slopes to increase your powder potential. Lower elevations, particularly southern exposures, had minimal coverage prior to this storm...many rocks and logstables remain just below the surface.

We are enjoying some wonderful powder skiing and hope you are as well! Thank you for submitting your observations and adventures on our [public observation/discussion boards](#).

A few spaces remain for the March 1-3 Level One Avalanche course, which will be the last course offered this season.

Safe Travels, Team KPAC

Friday, February 15, 2013

The Weeks Weather in Review

Since last week's dream storm, our customary post storm north, northwest and northeast winds ended the bliss (in many locations) dramatically redistributing snow in highly variable patterns and returning much of it to the atmosphere through sublimation. Now as high pressure sets in, temperatures are gradually increasing to seasonal norms and wind speeds diminishing somewhat,

characterized by gusty morning conditions dying out by midday.

The exception to this trend may be the reinvigorated turbulence on Friday, as a small disturbance passes and kicks up wind from the northeast. Regional warming is likely to continue with the freeze line migrating up to near 11,000 feet on Saturday, before being replaced by cooler air and a chance of precipitation later in the coming week.

Summary



The primary concern is wind slab resulting from redistributed storm snow. Wind slabs have been observed mainly in pockets above tree line and on cross-loaded sides of gullies and avalanche paths. This problem does not seem widespread, as once again many of the high elevation starting zones have become stripped of snow down to cinders. Wind slabs will be found on southerly facing starting zones and pockets on many aspects. As usual, backcountry travelers are encouraged to pay attention to and avoid wind slabs that have a hollow drum-like tone when tramped upon. Slides resulting from wind slabs are likely to be small to moderate in size given current conditions, but due to the high density of the material entrained in this type of avalanche, there is probably more likelihood of traumatic injury than complete burial. Evaluating the consequence of triggering a small slide and the terrain trap potential are important.

Of some concern is the warming that is forecasted for Saturday. Warming can cause short term softening of slabs making them more susceptible to human triggering.

Warming weather has allowed rapid strengthening and bonding of the snowpack, so storm snow avalanches are much less likely to occur naturally or by human triggers. Recent pit analysis shows that much of the temperature gradient has been lost from the lower snowpack and bonding of facets and depth hoar is occurring. This is reflected by increases in the hardness of basal layers, some of which have reached four-finger hardness. The exception to this is on northern slopes where some locations still show large poorly bonded advanced facets (depth hoar) at the bottom of the snowpack. Observations of depth hoar up to 4mm in size have been recorded. Although currently not showing signs of volatility (CTM scores of 17, Q3), this could change with the addition of a substantial new load, such as the addition of more than 1 inch of snow water equivalent (SWE) from new or wind transported snow.

Observers have reported that despite the snow stripped northwestern flanks of the Peaks at high elevation, good skiing and riding is still prevalent in the Inner Basin and below tree line on slopes protected from wind and direct sun.

Backcountry travellers are encouraged to report observations and snow pit data to our [public observation/discussion boards](#). Stay safe and have fun.

Tuesday, February 12, 2013 Supplemental Update

Summary

Since Friday night February 8th, approximate 36 inches of low density snow (4 to 7 % water) has fallen on the San Francisco Peaks at the 10,800 ft. stake at Snowbowl Resort. Approximately 1.5 inches of Snow Water Equivalent (SWE) and 18 inches of snow were recorded at the [Snowslide SnoTel](#) site. Pre-storm winds were vigorous out of the Southeast, South and Southwest, but settled down considerably during the main precipitation periods.



On Sunday some localized slab formation was observed with variability in the bonding with the underlying snowpack. Some instability within the storm snow at a subtle density break was also noted.



Northerly post storm winds are expected to increase with 50+ mph at ridgetops. Wind transported snow from the north and deposited as wind slab on southern and southwestern aspects near ridgelines and on the lee side of gullies is anticipated. Temperatures are forecast to

remain cool for a few days and gradually warm up, initially delaying the bonding process between the new snow and the old. Although the added load is not tremendous due the light low density character, wind loaded storm snow and wind slab may reinvigorate old weak layer of facets and depth hoar within the lower snowpack. Backcountry traveler should be aware of unstable storm slab and wind slab for the next few days until these have had a chance to bond and gain strength.

Friday, February 8, 2013

The Weeks Weather in Review

This past week has been mostly sunny and mild. Agassiz Peak Station reported temperatures between 17 and 39 degrees Fahrenheit with above freezing temperatures reached on February 2, 3 and 5 at 11,500 feet. The Snowslide Snotel station recorded temperatures between 14 and 45 degrees, with above freezing temperatures reached each day. Winds have been light to moderate. Arizona snowbowl reported ~1" of snow at 10,800' on February 3 and there was a dusting of graupel on the night of February 6.

Overall, the week's weather has led to increased bonding and strengthening of the snowpack. No natural or human triggered avalanches have been reported and stability has been ground truthed by a lot of ski testing, as many spectacular lines have been successfully descended. Except on north facing slopes at high elevation, mild temperatures have reduced temperature gradients even in shallower snow covered areas and some bonding of previously developed facets and depth hoar is occurring.

Remember: due to the angular nature of well-developed depth hoar and faceted crystals, strengthening is slow and never acquires the high strength of well bonded rounded grains. In the short term, further faceting is possible, but is more likely to occur in the upper snowpack as near surface facet growth. Temperature profiles from pits on northern and northwestern slopes show significant temperature gradients in the upper 40 centimeters of the pack rather than near the base. A gradient of at least 1 degree C per 10 centimeters, or 1/10 of a degree C per 1 centimeter is required for faceted growth.

Of some concern is the recent formation of a thin layer of surface hoar that formed on the night of February 6th as the clouds broke, temperature dropped and the dew point was reached. Surface hoar was observed at and below 11,500 feet on west and northwest facing slopes and may have formed elsewhere, such as in the Inner Basin. Most likely, these fragile forms will be obliterated by strong winds that are forecasted to accompany the approaching storm.

Where surface hoar is preserved, a new reactive weak layer may persist underneath fresh storm snow. Avalanches failing on buried surface hoar account for many deadly accidents throughout

the west. Locations where surface hoar may remain preserved will vary highly, therefore predicting it's distribution is challenging. Wind and sun protected zones are the mostly likely locations where surface hoar will be preserved. Also, narrow gullies below treeline where cold air is channelled promote surface hoar growth. Problems with this persistent weak layer are relatively uncommon here on San Francisco Peaks due to our destructive winds, but it's role in numerous fatal avalanche accidents, it's worth keeping track of.

Highlights of the current near treeline forecast for Feb. 8-10:

- strong ~southwest winds gusting to 50 mph
- Friday night the temperature will drop to -7 degrees Fahrenheit (wind chill values as low as -36)
- total snow accumulations of 1 to 2 feet are expected.

Summary



Wind slabs in our observations are stabilizing, but remain a concern, particularly on western and leeward aspects at or near tree line. Stability tests have not indicated reactivity with weak layers below. Some pockets of instability may still exist, but we cannot seem to find them in our limited investigation, nor have any wind slab avalanches or cracking slabs been reported. A fair amount of loose snow is still available for wind transport. Wind is forecast to precede the approaching storm, possibly building new wind slabs before the bulk of the precipitation arrives.



Storm snow is not currently a concern, however with the approach of a significant weather

system this may change in the next 48 hours. Rapid loading due to new snow or wind transport can quickly overburden the existing snowpack structure, activating previously benign weak layers.

As always, maintain safe travel practices and evaluate terrain stability on a slope by slope basis. Please report your observations to our [public observation/discussion boards](#).

Check our main site for educational opportunities. Space is available in the Level 1 course scheduled for March 1-3. Thank you for your interest and support!

February 1, 2013

The Weeks Weather in Review

Wow what a week. Close to four feet of new snow fell at 10,800 feet on Arizona Snowbowl Resort, turning the previously lean season around. A series of precipitation events graced our region, starting warm and rainy and ending cold, just the way we like it – right side up. After this storm, a number of natural avalanches (direct action avalanches) were reported in the Inner Basin.

Stormy conditions, which lingered into Tuesday were followed by warming temperatures and our typical post storm winds of 30-50 mph out of the northwest. These winds were more than sufficient to transport lots of snow, eroding many windward slopes nearly to pre-storm conditions and depositing wind slab on leeward slopes, but with a good deal of spatial variability. On Thursday and Friday temperatures climbed above 0 degrees C near treeline.

Summary



The primary avalanche concern are wind slabs from recently transported snow. Wind on Tuesday and Wednesday out of the north and northwest moved substantial loads of snow into south and southeastern starting zones. These have resulted in pockets and pillows of hard and soft wind slab that may not have bonded to the layer below. Although many of these slabs are strong and

unlikely to be triggered by a back country traveler, the consequence of doing so could be catastrophic as fracture propagation in these conditions can result in massive avalanches.

Travelers are urged to stay off hollow drum sounding hard snow on slopes steeper than 30 degrees. Hard wind slabs tend to fracture well above the trigger point. These seemingly stable hard slabs can lure skiers and riders out onto them before releasing, making escape extremely difficult. Such slabs will be found mainly leeward below ridgelines and on the flanks of chutes and gullies where cross-loaded pockets may have formed. Warming will increase the sensitivity of such slabs making triggering under a skier or riders body weight possible.



For the most part, storm snow from earlier in the week bonded quickly to the old snow surface and density breaks within the storm snow strengthened. However, weakness remains where the snowpack was previously dominated by facets and depth hoar. Such conditions do not seem widespread, but have been observed on cold northern and northeastern aspects at and below tree line and on some cold wind protected chutes. On these slopes, persistent storm slabs may linger. Recent stability tests performed on slopes with new storm slab sitting on top of facets have revealed moderate strength between new snow and old, moderate energy and improving snowpack structure, however more reactive pockets are still possible. Stability tests performed on slopes exhibiting these conditions have generally been in the range of CT 12 +, Q2 with no propagation when applying the ECT test.

With all of the wind hammering, shallow snowpack is still the rule rather than the exception. On northern slopes between 10,000 and 11,500 ft, wind erosion has resulted in snowpack depths of less than 80 cm. The snowpack on these slopes currently show sufficient temperature gradients to foster continued facet development. It will not take long for new storm snow to convert to poorly bonded sugar and thereby build the weak layer upon which future snow will load.

There is currently some wonderful powder skiing in the backcountry, hidden in the shaded wind protected zones between sun and wind crusts.

As always, report your observations to our [public observation/discussion boards](#) and travel safely (one at a time, from safe zone to safe zone with spotters) in avalanche terrain and utilize avalanche rescue essentials (transceiver, probe and shovel).

Happy trails!

Monday, January 28, 2013 Noon Time Supplemental Update:

In the past ~72 hours, ~3.5 inches of snow water equivalent (SWE) have fallen in the innerbasin ([snowslide canyon snotel](#)) of the San Francisco Peaks. Arizona Snowbowl received 33" of snow near tree line during this time period ([post](#)). The temperature was near freezing and the snow was dense and wet below treeline. The temperatures have now dropped significantly and the forecast predicts SW winds over 30 MPH and 5-9 inches of more snow. Back country users are now likely to deal with large new-snow slabs and wind slabs. These large slabs may be resting on weak facets and facet/crust "sandwiches".

Kaptain Safe T's [report](#) from our [public observation/discussion boards](#): "Bonding is very poor to old snow layer and weight of new snow has produced lots of energy in snowpack with easily triggered slabs on terrain over 30 plus degrees. Let things settle down till you start dropping in the steeps and keep an eye on each other....even in the trees there is quite a bit of collapsing..."

Coconino County [Avalanche Special Bulletin](#).

Stay alert and safe travels. The KPAC team.

January 25, 2013

The Weeks Weather in Review

Unseasonably warm temperatures and little precipitation characterized the past week. High pressure, which settled over our region produced temperatures as much as 10 degrees F above average. On January 24th the maximum temperature at 9700' was 49 degrees F (Snowslide Snotel Station), and 35 degrees F at 11,500' (Agassiz weather station).

Inversion conditions prevailed earlier in the week producing moderate minimum temperatures at upper elevations and cooler nights in basins where settling air pooled. Winds have been generally moderate to calm until Thursday introduced the week's first precipitation as one of several forecasted days of warm and wet conditions arrived. Precipitation is expected to continue with low cloud cover, mist, rain and snow at higher elevations. A wintery mix of ice pellets and rain was observed at elevations as high as 10,200 feet on Thursday. Light snow began to fall Friday morning at elevations above 10,500', possibly becoming more intense throughout the day and into Saturday.

Summary

Sunny and warm conditions early in the week have generally stabilized the snowpack, creating bonds between individual grains and layers. In most areas warm weather has also reduced the temperature gradient within the snowpack, thereby moderating the conditions responsible for faceted crystal growth.

Having said this, don't let your guard down, because plenty of poorly bonded facets have already formed. These resist bonding to one another because of their angular shape with few points of contact. Surprisingly, on Thursday an Inner Basin test pit revealed poor strength, poor structure and unexpected high energy as a series of compression tests failed at: CTE 1, 1 and 3; Q1, with a sudden collapse breaking to the ground. We are hoping these results on a westerly aspect at 10,200' were isolated anomalies and not representative of a persistent slab problem. Thankfully the fracture did not propagate using an extended column test.

However this example supports other observations of high variability in our snowpack. Additionally, we must keep in mind that much of our mountain snowpack now consists of facets and depth hoar, especially on shaded north through east aspects. Although these conditions are generally stable, this is likely to change with the addition of new snow or precipitation.



Rain on snow. This week's mid winter rain at elevations above 10,000' is relatively rare on the San Francisco Peaks. These conditions are forecast to continue, and possibly add as much as an inch or more of water to the snowpack. In the short term, this adds warmth, breaks bonds between grains, and adds load, stressing weak layers below the surface. When enough rain is added to the existing weak snowpack, wet loose snow and wet slab avalanches are possible. These are more likely to be natural direct action avalanches, but can be skier triggered. Wet avalanches are unpredictable, and potentially very destructive due to the high density of debris.

The current weak basal structure of the snowpack makes wet avalanche activity more likely. At the moment there seems to be considerable uncertainty regarding the freeze line elevation of the approaching storms. This determines the elevation where rain turns to snow and will have a significant bearing on future instability depending upon whether travelling above or below the rain snow boundary. Concerns with increased snowfall include the added weight and formation of wind deposited slabs; whereas rainfall adds weight along with weakening the snowpack as water percolates downward.

Looking forward, the wet surface snow will turn to crust once temperatures fall and return to seasonal norms. Rain on snow can also provide conditions for tiny facets to grow, either at the bottom of the crust where warm wet snow meets old cold snow; or above the crust if abruptly covered by new cold snow. Backcountry travelers should pay attention to this crust by examining it carefully for the facet/crust sandwich, a subtle but very dangerous persistent weak layer.

Along with issues related to the rain event, another concern is development of weak layers as new snow arrives. The calm between storms is when weak layers develop. New snowfall transported by wind may form slabs that cause weak layers to fail or become poised to fail with the addition of a skier or snowboarders weight. Tracking weak layer development and their distribution can provide a tool for predicting what will happen after the storm arrives.

Stay tuned! Fresh snow is in the forecast for the upcoming week. We hope to ground truth our speculations. Be careful out there; don't let relief from the drought of the last two weeks cloud your judgment by falling into the scarcity heuristic trap.

As always, please submit your observations, profiles and adventures to our [public observation/discussion boards](#).

Consider attending one of two 'Introduction to Avalanches' seminars next week:
February 5, Tuesday, Hart Prairie Lodge, Arizona Snowbowl, 4:00-6:00 p.m.
February 6, Wednesday, Aspen Sports, 15 North San Francisco St, 6:00-8:00 p.m.

Safe Travels!

January 18, 2013

The Weeks Weather in Review

Following 7 inches of snow last Thursday, January 10th, Northern Arizona settled into a comparatively calm weather pattern with moderate wind out of the North. Polar cold air encroached upon our region with some of the most frigid conditions recorded in over 20 years. Flagstaff airport recorded -9 degrees F and temperatures at 11,500' were close to the same. On Tuesday, January 15th, brisk winds returned, blowing out of the North at optimum speeds to transport low-density high elevation snow. The week wrapped up with warming conditions and above freezing maximum temperatures at 11,500 ft. The current weather outlook calls for locked in high pressure and a dry forecast in the immediate future.

Summary

The cold temperatures early in the week created optimum conditions for kinetic metamorphism, promoting faceted crystal growth within the snowpack and delaying bonding between new or

wind blown snow and the snow beneath



Midweek windy conditions transported sufficient snow to create pockets of potentially dangerous wind slab. Evidence of a recent natural slide was reported on January 15th in the Telemark Path (refer to the observation posted on this event in the discussion boards). Others reported shallow wind slab and wind crusts on a variety of aspects above and below treeline but were unable to initiate failures.

During the last few days, warming conditions softened slabs making them fragile and more easily triggered with less force, but also speeding up bonding of new snow to old. Over the week we have had a bit of everything, and significant variability in the snowpack remains. This is particularly true with snowpack depth.

High elevation terrain continues to be mostly stripped of snow, with the exception on wind protected chutes, a number of which have been skied recently. Potential avalanche problems are most likely near tree line and in pockets of wind slab, deposited on Tuesday.

On southern aspects, solar radiation has produced a number of crusts and layers, which could produce a slide if covered by wind slab. Northerly, cold and shaded slopes at and below tree line are dominated by faceted snow, often from top to bottom, which may not support the weight of a skier. With just a meter of snow or less, please exercise caution and avoid punching through to hazards just below the surface.

Layers within the snowpack on these slopes seem relatively well bonded despite the overall weak structure. Pit test results have failed to show fracture propagation on northwest, west and northeast aspects below treeline. Compression test scores indicate good strength and poor shear quality in these same pits. However, snow pits reveal what is happening in that exact location and there is a high degree of spatial variability.

As always, backcountry users are encouraged to assess the individual slopes they intend to ski and use prudent travel practices. Please report conditions, avalanche activity and your backcountry adventures to our website: www.kachinapeaks.org.

Despite the relatively shallow snowpack, some good skiing opportunities exist where wind and sun have not adversely affected the snow quality.

Safe travels!

January 11, 2013

The Weeks Weather in Review

In general, the past week has been characterized by increasingly calm and warmer temperatures as high pressure settled into the region. High elevation winds blew earlier in the week, however at high elevations, very little snow was available to be moved about; either locked in pencil hard wind slab or absent altogether. Turbulent snow transport has continued below tree line in open areas and glades. The week ends with a renewal of strong wind (in excess of 50 mph) out of the southwest, frigid temperatures (wind chill to -40 F at 12,000 ft.) and moderate precipitation as a slow moving cold front passes through our area.

Summary

The calm before the storm did two things to the snowpack.

First, this period between storms allowed layers within the snowpack to bond and strengthen. Stability tests performed near tree line and below have indicated good strength and low reactivity on all aspects. Compression and Extended Column Test results of CT-Moderate and CT-Hard (14-26 taps), poor quality shears (mainly Q3) and no fracture propagation were recorded. See Troy Marino's [post](#). Pits were dug on SW, SE, NW and NE aspect at and below tree line.

Secondly, some weak layer development has been observed. Faceting, in the snowpack is progressing in various ways. Facets are developing from the bottom on cold slopes where coverage is shallow, in fact most below tree line pits of less than 50 cm of depth are comprised primarily of faceted forms a various stages of development. In addition, near the surface facets have been observed at tree line, particularly on southerly exposures, where we suspect warm days and cold nights early in the week caused diurnal recrystallization. Some surface hoar (faceted snow) was observed in the Inner Basin on north and northeast aspects. Additionally, poorly bonded wind slabs over facets have been reported on east and northeast aspects – see [post](#). All of these forms, if buried by sufficient new snow could cause avalanching.

With approximately 5 to 7+ inches of new snow deposited above 9,500 feet in the January 10-11 storm, it seems unlikely that sufficient load will be added to weak layers to cause problems, however there may be two exceptions.



Wind Slab may develop on lee slopes at and below tree line. Wind loaded aspects are likely to be northerly and northeasterly facing, resulting from storm loading and possibly southerly facing if we get hit with the typical post storm northerly winds. Above tree line slopes are less worrisome because of the absence of underlying snow.



Storm snow could be a problem if it falls upon, buries and thereby preserves surface hoar. Although this happening seems unlikely given the battering wind on Thursday, which would typically obliterate fragile surface hoar, treating below tree line protected slopes with healthy suspicion would be prudent just in case – especially north through east facing pockets.

Keep in mind, both wind slab and storm snow avalanches are most prevalent soon after they are laid down. However since cold temperatures are forecasted to linger, prolonged bonding between the new and old snow interfaces particularly on the colder north and northeasterly aspects are likely. Also, the cold shot will continue to provide the conditions favorable for further facet development.

It is still a shallow snowpack, watch for gremlins just under the snow.

January 4, 2013

The Weeks Weather in Review

Wind, wind and more wind once again characterized the past week. Another storm passed through Arizona at the end of 2012 bringing 8-10 Inches of snow. This was followed by wind out of the North and Northwest, stripping these aspects and potentially loading S and SE slopes. On Thursday a low-pressure system to our South created a strong pressure gradient northeasterly wind, scouring this aspect, and blowing the snow into the far off desert lands. Overall, due to variable wind directions, most snow above tree line has been stripped.

Summary

The snowpack seems to have gained some stability with time. The previously reactive graupel layer has bonded and gained strength, no longer producing weak stability test results found last week. Recent stability tests still show fractures on this layer, but it is much more difficult to initiate a failure (CT22 Q2 and no fracture propagation on extended column (ECT) tests).



It is still likely that there are lingering pockets of instability in the form of wind slab, particularly near tree line and below, mainly on southerly aspects. This is our primary concern. If you are standing on top of firm snow that has a “hollow, drum-like” sound to it, you are most likely standing on a wind slab. Due to the long period of high winds, wind slabs may have formed well downslope below the ridgelines; not where you would typically find them. All slabs and particularly those near terrain traps such as steep narrow gullies should continue to be treated with suspicion and respect. Think about the consequences of where you might be carried if a small slab breaks out from underneath you. As a reminder, we have not had ample opportunity to thoroughly investigate all aspects and elevations so, please treat this summary with appropriately guarded skepticism, make your own assessments and contribute to our body of knowledge by reporting your observations on our [public observation/discussion boards](#).

Keep in mind that calm periods between storms can create weak layers that, once buried, may become problematic in the future.

Warm temperatures are forecast this coming weekend – this may have the affect of weakening wind slabs. At the moment, the backcountry snowpack is shallow and variable below tree line and almost non-existent above. Stay alert for hidden obstacles in the shallow snowpack.

December 28th, 2012

The Weeks Weather in Review

In the past week the San Francisco Peaks received two storms. The first dropped between 3 – 6 inches of new snow, much of which fell as graupel (little balls of heavily rimed snow crystals) on the 24th. The storm was accompanied by dramatic post-storm winds out of the Northwest, gusting 80-100 mph.

Once again, exposed high elevation starting zones were stripped down to cinders in very similar patterns to those resulting from wind events of the week before. Some snow was loaded in hard drifts and slabs on Southerly and Easterly aspects, but most seemed lost via sublimation back to the atmosphere.

On Wednesday and Thursday a more productive storm laid down 10-16 inches of low-density powder with light to moderate wind out of the Northwest. The wind picked up from the Northwest during the early morning hours on Friday December 28th (20-36 mph with gusts into the 40's) transporting much of the new onto Southeastern aspects.

Summary



The primary high elevation avalanche problem is wind-loaded slab from both storms laying on a weak layer of graupel or other unidentified weak layers that may have developed earlier. Stability tests have shown poor bonding between a well defined graupel layer and snow above (Compression Test results: CT3 Q2 however no fracture propagation using the Extended Column Test).

A high level of uncertainty exists due to a lack of opportunity for observers to cover much ground since the end of the most recent storm, combined with high spatially variability in the overall snow cover.



A secondary concern is storm snow. Soft slab from the most recent storm may not have had adequate time to bond to old snow below. This problem could exist on any aspect but is most likely on wind loaded lee slopes (Southeast during this last storm cycle).

In General, backcountry travel should treat wind deposited areas conservatively and avoid slabs particularly if they seem hollow or resonate like a drum. Typically, wind slabs tend to exhibit highly variable thickness (and therefore strength) making this avalanche problem difficult to assess using snow stability tests of strength. In other words, what you find in a snow profile may not be what exists in the starting zone.

Looking into the future

Areas where the snowpack is thin (due to recent wind erosion), are locations where future faceting is likely to occur. This will take place in the upcoming days and weeks. Shallow snowpack combined with cold air temperatures supply the conditions for “Kinetic Metamorphism” the process that creates “sugar snow” or facets as they are known to snow scientists.

Facets create potential deadly weak layers, once this poorly bonded snow is covered with new storm or wind-blown snow. Observing the patterns of where shallow snow cover now exists can help backcountry travelers predict where future weak layers may form.

For enthusiasts searching for powder turns from this most recent storm, seek out wind and sun sheltered terrain.

Keep in mind the snow is still relatively shallow and hazards may be just below the surface. Focusing travel exposure to moderate slope angles (below 30 degrees steepness) and wind scoured terrain will minimize the likelihood of triggering an avalanche.

Thank you for reading and Happy New Year from the Kachina Peaks Avalanche Center.

December 21, 2012.

Overview of early season snow and wind storms

- A pre- Thanks giving storm deposited 10-12 inches of new snow to the Peaks. On Southerly aspects (slopes facing S, SE and SW) most of this snow was lost to the above average temperatures that followed. However, some snow from this early season storm remains in pockets or on cold wind protected aspects (N, NE and NW). In these locations the snow has turned to a basal layer of sugar (poorly bonded faceted crystals).
- Between December 14th and 16th we received between 21 and 32 inches of fairly dense snow via a secession of moist quick moving storms. Winds loading from the storm cycle favored Northeastern slope initially, however post-storm wind from the Northwest in the moderate range (15-30 mph on ridge-tops) scoured some high elevation slopes and loaded some Southern slopes and cross-loaded some West facing gullies.
- A quick moving storm on the night of December 18th produced 6 to 12 inches of new snow, followed by 18 hours of gale force Northwesterly wind on December 19th. This wind event stripped snow from high elevations starting zones and deposited snow that wasn't lost to the atmosphere onto Southerly facing slopes

Summary

What we are left with are some pockets and starting zones of fairly hard wind slab (pencil to one finger hardness) on Southerly aspects at high elevations, but for the most part starting zones are scoured on other exposed aspects. So far this season, the backcountry seems way too reminiscent of last winter's conditions. There is also a great deal of variability in the snowpack structure (where snow remains) so slope by slope analysis is critical since generalizing is impossible.



The primary problem that exists is “Wind Slab” not well bonded to the layer below. These will be found on Southern facing slopes near ridge tops or the southern facing flanks of gullies where cross-loading has occurred. Although our limited test pit sample did not reveal dramatic instability (we say fairly high strength and no propagation), we are not confident that this was a representative sample.



A secondary problem is “Storm Snow” from recent storms resting on a weak layer, such as early season snow (that may have metamorphosed to facets) or on other weak layers such as a variety of crust that have been observed. This problem could be present on any slope 30-45 degrees in steepness that has been recently loaded with snow during the storm cycles.

Backcountry travelers are urged to use caution, carry proper equipment, use excepted travel procedures, evaluate the snow carefully and are invited to report their observations to kachinapeaks.org

[KPAC public observation/discussion boards.](http://kachinapeaks.org)