SPECIAL AVALANCHE WARNINGS AT THE CANADIAN AVALANCHE CENTRE

John Kelly[1], Ilya Storm[1] and Jim McAllister[2]
[1]Canadian Avalanche Centre, Revelstoke, British Columbia, [2]British Columbia Provincial Emergency Program, Victoria, British Columbia.

ABSTRACT

This poster describes the Special Public Avalanche Warning Program. The Canadian Avalanche Centre with the support of the British Columbia Provincial Emergency Program issues Special Public Avalanche Warnings for times when winter backcountry travellers are expected to face elevated avalanche risk. The decision to issue a warning follows established criteria that capture periods when recreationists' perception of risk won't map well onto existing or forecast conditions. Because of the focus on perception, our analysis incorporates both physical and human factors to anticipate the need for issuing a special warning. Integrating both traditional avalanche forecasting factors and insights into the psychology of decision making means warnings are rarely issued during periods of high avalanche activity. Common profiles for issuing warnings will be described. Special Public Avalanche Warnings are infrequently issued, carefully targeted messages that remain in effect for a short period of time. They cover carefully defined geographic areas and target specific backcountry user groups. Warnings identify specific avalanche safety issues and provide guidance for how to improve your chances for a safe recreational experience. They consist of: notifying partner agencies; a press release; a targeted media campaign; an avalanche forecast, report, or warning product and update as required by changing conditions, and; avalanche forecaster availability for media and public enquiries. We feel the Special Public Avalanche Warning program may be one of our most effective communication devices that assist our users successfully manage their avalanche risks.

KEYWORDS: Avalanche, Avalanche Warning; Avalanche Accident; Avalanche Forecasting

1. PROGRAM EVOLUTION

The Special Avalanche Warning program began as a suggestion from the British Columbia Provincial Emergency Program (PEP) that certain weather conditions could lead to elevated risk for avalanche accidents involving recreational backcountry users. Because weather forecasts are predictive, it may be possible to anticipate periods of elevated risk hours or days in advance. In the fall of 2003, PEP offered to provide additional funding to the Canadian Avalanche Association (CAA)* for special avalanche warnings each winter season.

After significant deliberation and consultation, the CAA proposed to PEP that periods of increased risk of avalanche accidents are determined by three main factors: weather, snowpack conditions and human behaviour, and not from weather alone. Consequently a program of special warnings of increased risk of avalanche accidents should be based on inputs drawn from each of these factors. Discussion with PEP quickly affirmed that the goal of the program was to provide effective warnings with the aim of reducing avalanche accidents, and the expertise of the CAA should be fully exploited to identify appropriate occasions.

Analysis of avalanche accidents in Canada (CAA data- Figure 1.) quickly led to the conclusion that there is no linear relationship between avalanche accidents and avalanche danger rating. Few

*The Canadian Avalanche Centre (CAC) did not exist as an independent organization prior to October 2004. The SAW program was initiated within the Public Avalanche Bulletin program at the Canadian Avalanche Association. This program has since been integrated into the CAC. For the purposes of this paper, the designations CAA and CAC can be used interchangeably.

avalanche accidents occur when the avalanche danger is extreme and most avalanche accidents occur when the danger is considerable.

Discussion with Canadian Avalanche Centre (CAC) avalanche forecasters also revealed that forecaster confidence in avalanche danger is lowest when the avalanche danger is Considerable. While forecasters were relatively confident in the accuracy of their forecasts when the danger was Low or Extreme, they were less confident in the middle reaches of the danger scale, especially at the Considerable danger level. In particular, CAC forecasters wrestle with the characteristics of persistent weak layers of buried surface hoar and facets that may cause variability in avalanche activity in both space and time.

CAC public avalanche forecasts are limited to regional scale analysis and guidance. Although our products comment on terrain features and types of avalanche terrain at a generic level, basin- and slope-specific decisions are firmly the responsibility of individual recreationists. The distribution of recreational avalanche fatalities indicates that recreationist's also wrestle with making good slope-specific decisions during periods of Considerable avalanche danger (Figure 1)

Patterns of avalanche terrain use by recreational users were the main human factor identified leading to elevated risk of avalanche accidents. Obvious weighting of recreational avalanche accidents to weekend and holiday periods provided an easy first indicator of elevated risk from human factors. Expert consultation also proposed that backcountry boldness tends to increase faster than conditions stabilize following major storm events. The problem of appropriately adjusting to changing conditions appears to be most difficult when recreation opportunities improve dramatically breaking a long period of "poor" quality and limited recreational opportunities. Examples include when a long snow drought is finally broken or the first blue sky day after a extended storm pattern release people from below treeline terrain. This situation multiplies in importance when persistent weak layers such as buried surface hoar or facets are present in the deeper layers of the snowpack.

An additional behaviour factor suggested as leading to increased risk of avalanche accidents is the relative unfamiliarity of recreational users of avalanche terrain with the details of avalanche activity at the slope specific scale. Detailed knowledge of when and where avalanches occurred, the history of avalanches on given terrain and observation of incremental changes in snowpack structure can help professionals to safely use certain slopes when adjacent slopes with the same terrain characteristics may be unsafe. The minute and ongoing observation of slopes and terrain required to make such determinations is usually beyond the reach of most recreational users of avalanche terrain. Consequently there is a possibility that use of terrain by professional operations may lend false encouragement for recreational users to use nearby terrain.

Occasions when professionals are making unusually conservative terrain choices are shared with the CAC through the daily industry information exchange, and this information can be transmitted to the public via avalanche forecasts and in extreme cases in Special Avalanche Warnings.

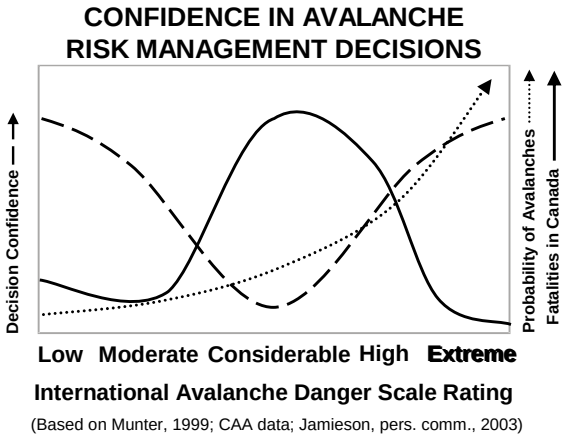

Figure 1. Confidence in Risk Management Decisions, Frequency of Avalanche Accidents, and Probability of Avalanches by Danger Rating

2. PRINCIPLES

The aim of the special avalanche warning is to provide recreational backcountry users with prior warning of a period of increased avalanche risk; to provide insight into why there is increased risk and to offer suggestions on how they may lower the amount of risk that they are exposed to during their backcountry outing.

Following consultation and internal discussion the CAC forecast team proposed some informal principles guiding the release of Special Avalanche Warnings.

1. The primary factor triggering the issue of a special avalanche warning is the determination by the CAC Duty Forecaster of a higher risk of accidents involving recreational users of avalanche terrain within the forecast period within an area covered by CAC avalanche forecasts or reports.
2. Special Avalanche Warnings are to be used conservatively – to preserve impact of the product and not induce warning fatigue in users of CAC bulletin products.
3. The CAC will not be able to provide a Special Avalanche Warning prior to every avalanche accident. Avalanche accidents occur at all avalanche danger levels and under every weather condition. It is not possible to foresee or prevent all of them.
4. The predictive variable with the most impact on whether avalanche accidents will happen is forecast weather.
5. The CAC works in close cooperation with a variety organizations involved in public avalanche safety. Special Avalanche Warnings must be coordinated with all stakeholders.

3. STRUCTURE

A Special Avalanche Warning consists of:

1. A press release, ideally issued 24 hours prior to a period of elevated risk of avalanche accidents
2. A targeted media campaign that persists through the anticipated warning period
3. Additional or updated avalanche forecasts as required.
4. Availability of forecast staff for media and public enquiries during the Special Avalanche Warning Period.

CAC forecasters monitor long range weather forecasts and analyse snowpack structure to identify periods where a Special Avalanche Warning might be necessary. Potential Special Avalanche Warning Periods have been identified up to 10 days in advance.

Where possible the CAC uses this advance knowledge to communicate and corroborate with contributors of avalanche safety information, public safety agencies, and other providers of public avalanche warning information. This heads-up warning is intended to allow these organizations to focus on collection of pertinent information that may assist in determination of whether a warning is necessary; its timing; to prepare for increased public profile of avalanche conditions; and to help in determining levels of preparedness for accident response

The public messages of a Special Avalanche Warning follow similar principles to all public information products at the CAC. In communication concerning the SAW CAC forecasters attempt to: Identify the timing and spatial extent of the elevated risk of avalanche accidents; identify the characteristics associated with the elevated risk; and offer suggestions of ways to reduce risk exposure.

4. EXAMPLES

4.1 Special Avalanche Warning “Heads-Up”

Dear Friends and contributors,

The Canadian Avalanche Centre will emit a special public avalanche warning on Friday, February 10, 2005 covering the period Saturday February 11, 2006 to Sunday February 12, 2006. This warning will be narrowly targeted to areas near the Rocky Mountain Trench, that is to say the east slopes of the Purcells from Golden to Cranbrook, parts of the Elk Valley, the east slopes of the Cariboos from south of Valemont to south of Prince George and the BC Rockies.

We are in the process of preparing our communication strategy which will focus on significant warming, clear weather and an expected surge in backcountry use. Our messages will indicate what backcountry users can do to decrease their risk. We are not recommending that people stay out of the mountains, rather they should carefully consider their route and exposure.

This will be the second special avalanche warning of the 2005-06 winter season warning consisting of a targeted press release, a media campaign, and an avalanche forecast and update (as required by changing conditions).

We expect avalanche danger will be Considerable in the alpine of the affected area through the weekend. Here are the key contributing factors to the need to produce this warning in their relative order of importance.

1. The weather will be spectacular for backcountry activities and there is a pent up demand to get out into the terrain. This will place many people on the slopes and there may be several “human factors” that will place people in harm’s way. Scarcity of fresh tracks will push people further and further into the mountains, leaving heavily travelled terrain that is relatively safe owing to well compacted snow layers and heading out to virgin territory where the avalanche danger may be significantly higher.

2. Warming that will bring sun and temperatures well above zero in an elevation band between 1500 and 2500 m in the interior mountain ranges on Saturday.

3. A pre-existing weak layer of facets and surface hoar exists deep within the snowpack and has been responsible for a number of recent large avalanches including some close calls. These avalanches will require something like cornicefall, or a large trigger such as a snowmobile to release, although some thin snowpacks could see skier triggering as well.

We feel that this is a situation where backcountry users will be tempted to go from very cautious use of the backcountry to very bold use of steep alpine terrain too quickly. Unless people are intimately familiar with the terrain, avalanche danger signs and this season’s and long term avalanche history, they should ramp back their expectations and “pull in their horns”. Avalanche danger below treeline is minimal and there are lots of very safe routes and places to go. We are only worried about large open slopes at treeline and above – or exposure to the same.

John Kelly
Operations Manager
Canadian Avalanche Centre
Box 2735, Revelstoke, BC. V0E 2S0
250-837-2435

Figure 2. Special Avalanche Warning “Heads-up” February 9, 2006.

4.2. Special Avalanche Warning Press Release

FOR IMMEDIATE RELEASE

SPECIAL PUBLIC AVALANCHE WARNING

February 10, 2006, Revelstoke, BC: The Canadian Avalanche Centre (CAC) is issuing a special public avalanche warning for the period of Saturday February 11 to Sunday February 12. This warning applies to many of the mountainous areas of the BC interior, specifically the east slopes of the Purcells from Golden to Cranbrook, the east slopes of the Cariboos from Valemont to Prince George, and all the BC Rocky Mountains.

The warning is brought about by a combination of factors, both human- and snowpack-related. This coming weekend, much of BC is expecting clear weather and the first blue skies for a number of weeks. This will be an invitation for many backcountry enthusiasts to get above treeline. However, the CAC forecasters want to draw attention to a weak layer deep within the snowpack at that higher elevation. This layer has been responsible for a number of very large avalanches recently, including some close calls.

"There is a lot of pent-up demand to get into the alpine," explains CAC forecaster Greg Johnson, "but the avalanche conditions there are quite a bit different than at the lower elevations. In the rush to get first tracks, it's not uncommon for people to lower their guards, or compromise safety protocols. But this is absolutely the wrong time to cut corners, especially if you are in an area that hasn't been packed down by frequent use. That weak layer is deep and when it fails the resulting avalanches are huge. All it takes is a trigger like a cornice fall, or a snowmobile, or even a person."

Travelling safely in the alpine this weekend will require familiarity with the terrain, awareness of avalanche danger signs and a thorough knowledge of the area's snowpack and avalanche history. The CAC urges all those who don't have those prerequisites to adjust their expectations accordingly. "Avalanche danger below treeline is minimal and there are lots of safe routes and places to go," says Johnson. "Our only concerns are the large open slopes at treeline and above."

To reduce *your* risk of being involved in an avalanche accident, you need to have at least basic training such as a recreational avalanche course. You also need the appropriate avalanche rescue gear, including an avalanche transceiver and a collapsible probe and shovel, and consult the avalanche and weather conditions before heading out. Public avalanche forecasts and information reports can be obtained at www.avalanche.ca or by phone at 1-800-667-1105. If there is no forecast for your area, local experts and experienced backcountry users can help you find the information you need to manage your risk in the mountains.

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For More Information Contact:
Greg Johnson, Public Avalanche Forecaster (250) 837-2435

Figure 3. Special Avalanche Warning Press Release February 10, 2006.

4.3. Avalanche Forecast

South Columbia Avalanche Forecast **Date/Time issued:** Friday, February 10, 2006 at 5:00 PM
Valid until: Monday, February 13, 2006

This forecast includes the southern Columbia Mountain range, including the eastern Okanagan Valley, Monashee, Selkirk and Purcell Mountain ranges. This region includes the eastern side of the Okanagan Valley from Osoyoos to Enderby, areas south of Highway 1 from Sicamous to Golden, areas west of the Columbia River between Golden & Kimberley, and areas north of Kaslo and northwest of Castlegar. This region does not include Glacier National Park. This region services backcountry recreationists from the Okanagan, west and east Kootenays, Nakusp, Revelstoke, Golden and Invermere areas, as well as other visitors to southeastern BC.

Forecast of avalanche danger Friday, February 10, 2006

	Friday	Saturday	Sunday	Monday
Alpine	Considerable	Considerable	Considerable	Considerable
Treeline	Moderate	Considerable	Moderate	Moderate
Below Treeline	Low	Moderate	Low	Low

The Canadian Avalanche Centre has issued an avalanche warning in the areas along the Rocky Mountain trench. In this forecast region that includes the mountains near **Golden, Invermere and Cranbrook**.

Travel Advisory: **The avalanche danger will increase significantly on Saturday, especially on south and west facing slopes.** A long time mountain guide once said to me something like, 'you know I've seen a lot of very big avalanches when the stability was good or the snowpack was mostly stable'. This is probably because he has experienced over and over deep weak layers persisting in the bottom portion of the snowpack, while little instability exists in the upper section; a good description of our current condition. Warm temperatures on Saturday will start to melt the surface snow and we expect some natural avalanche activity will occur. We are worried that unstable cornices may fall triggering large avalanches or that melting snow on rocky faces will slide off also triggering larger slides. While large avalanches are not widespread and you might not see one, this is a serious condition because those weak layers are in most places at treeline and above. In recent days avalanches triggered on deep weak layers were so big that it would be unlikely to survive if caught. We recommend choosing terrain carefully this weekend. This includes riding lower angle slopes at high elevations and not grouping up at the bottom of slopes you are highmarking or skiing. Also, trigger points with the deep instability may be in thin snowpack areas along ridgelines, steep rollovers and areas with a lot of rocks. One more thing, watch for the old lurking windslab just below ridgelines. The wind blew hard this week.

Avalanche Activity: During the past week there was a steady string of natural and explosive triggered avalanches that ranged in size from 2.0 to 3.5. A number of the naturals were from cornice falls.

Snowpack: The upper portion of the snowpack is continuing to consolidate and gain strength. The most significant features continue to be the December and November weak layers buried deep.

Weather: High pressure will bring clear skies and warm temperatures on Saturday. Daytime highs at treeline will be around +2. On Sunday an approaching cold front will lower freezing levels to around 1200m. On Monday the front will spread clouds and light precipitation and bring cold temperatures.

Issued by: Greg Johnson

Figure 4. Avalanche Forecast February 10, 2006

4.4. Media Activity Subsequent to SAW

	Date	Media Outlet	Location	Topic
SAW	06 02 10	Kamloops Radio	Kamloops, BC	
	06 02 10	The Weather Network		SAW
	06 02 10	CBC Calgary		SAW
	06 02 10	CHQR	Calgary, AB	SAW
	06 02 10	Calgary Sun	Calgary, AB	SAW
	06 02 10	CBC provincial		SAW
	06 02 10	Chum.TV, City Tv Calgary	Calgary, AB	SAW
	06 02 10	City TV	Calgary, AB	SAW
	06 02 13	Calgary Herald	Calgary, AB	General interest story/ freelance article
	06 02 13	WBSJ		
	06 02 13	Weather Network		Accident involvement or fatality K Country
	06 02 13	CBC Radio French		Accident involvement or fatality K Country

Table 1. Media Activity Subsequent to February 10, 2006 Special Avalanche Warning

5. EVOLUTION

Over the three years of the Special Avalanche Warning Program the CAC has come to see the SAW as an exercise in media relations as much as direct interaction with the backcountry user. The difficult notion (especially to non users of avalanche terrain) that risk to people is not proportional to either avalanche danger or frequency of avalanche occurrence has also been a difficult sell with a media that is very much preoccupied with sensational weather events and extreme avalanche cycles – precisely the type of occurrence that poses very little risk to the recreational user as the danger is obvious and visceral. Constant reinforcement of the key message that avalanche accidents occur under sunny skies *after* the storm is over has gradually encouraged a higher basic level of media reporting and more nuanced and informative pieces on avalanche danger and risks to backcountry users.

In spite of communications challenges, it is clear that the main ally in the distribution of Special Avalanche Warnings is the media, and consequently the effort to guide reporters to the correct stories about avalanche risks is essential. During a special avalanche warning the Duty Forecaster at the CAC will proactively call targeted media outlets to seed them with the story. This activity will continue through the period covered by the SAW and may involve up to 10 contacts with main media collaborators. These collaborators tend to be local media outlets in mountain communities threatened by the increased period of risk. The CAC experience with media during a SAW is that local media tend to be very interested in transmitting the best possible information to backcountry users and will often be the most timely and most accurate vehicles for the messages surrounding the SAW.

The pre-warning period has also evolved. As CAC forecasters observe emergent conditions for potential Special Avalanche Warnings the forecast team will discuss the implementation of special period strategies that are independent of but linked to the Special Avalanche Warning program. Such a period occurred in January 2006. A serious deep slab instability prompted the forecast team to develop a period strategy that included the placement of articles explaining deep slab instabilities in 12 local daily and weekly newspapers in British Columbia. Ultimately, no SAW was issued.

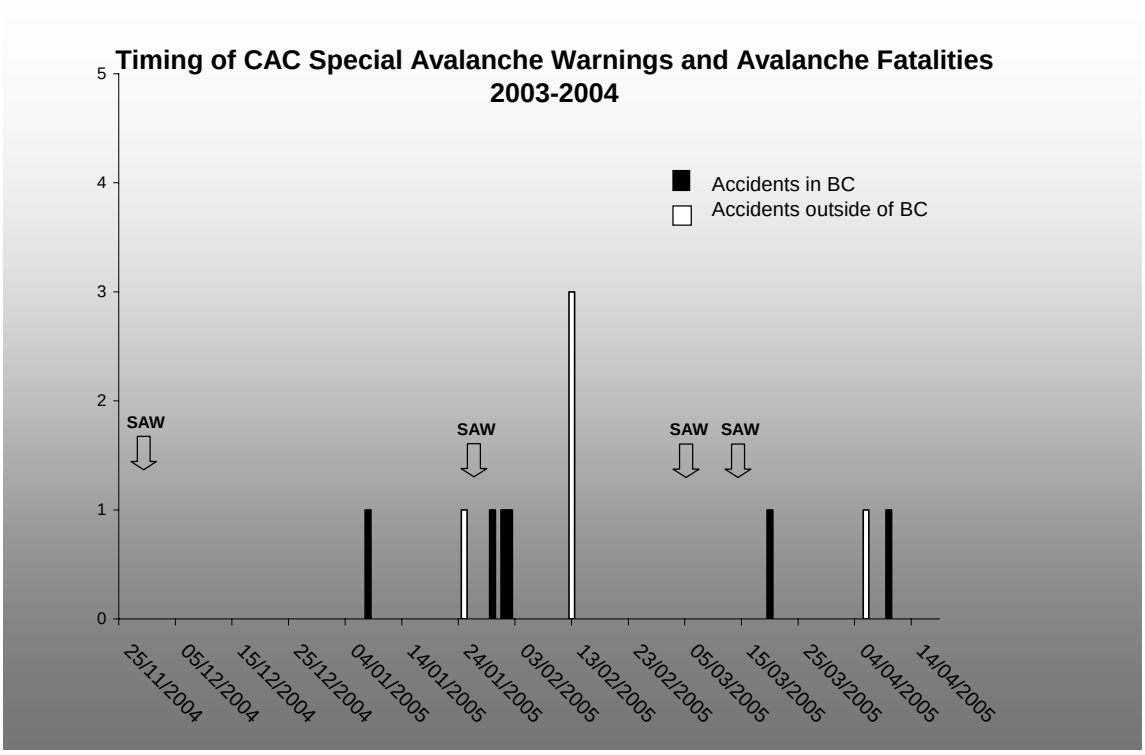

Figure 5. SAW frequency and avalanche accidents in 2003-04

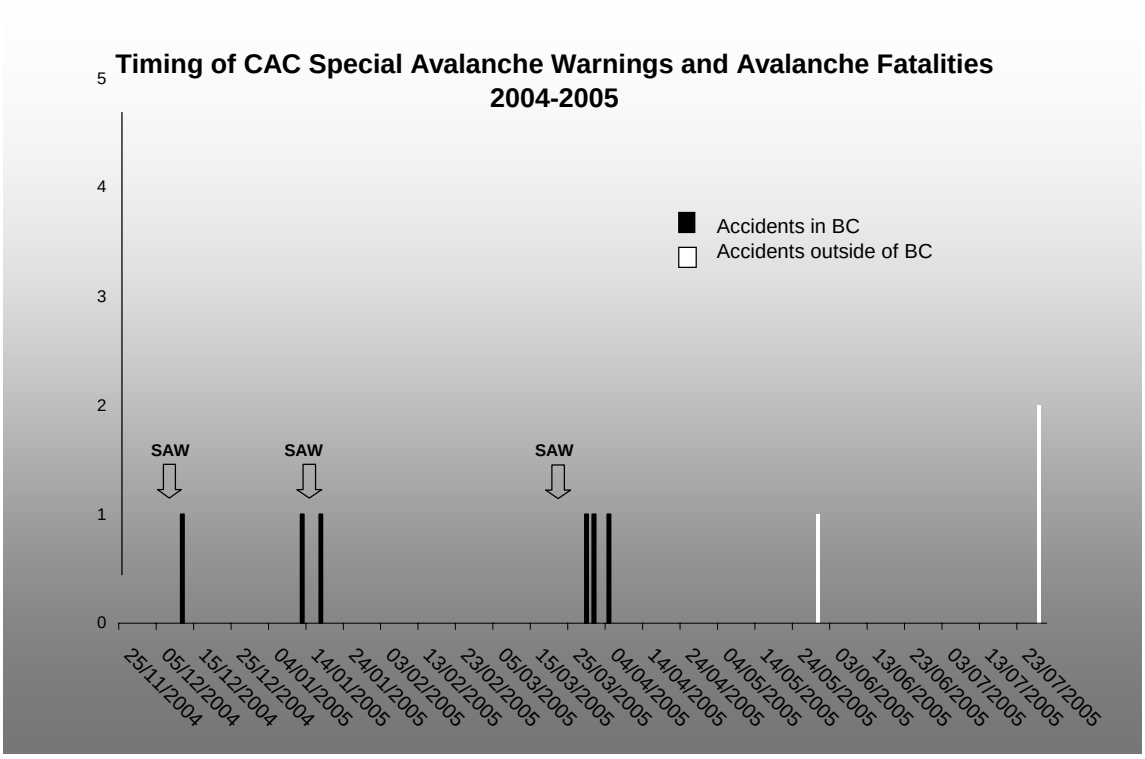

Figure 6. SAW frequency and avalanche accidents in 2004-05

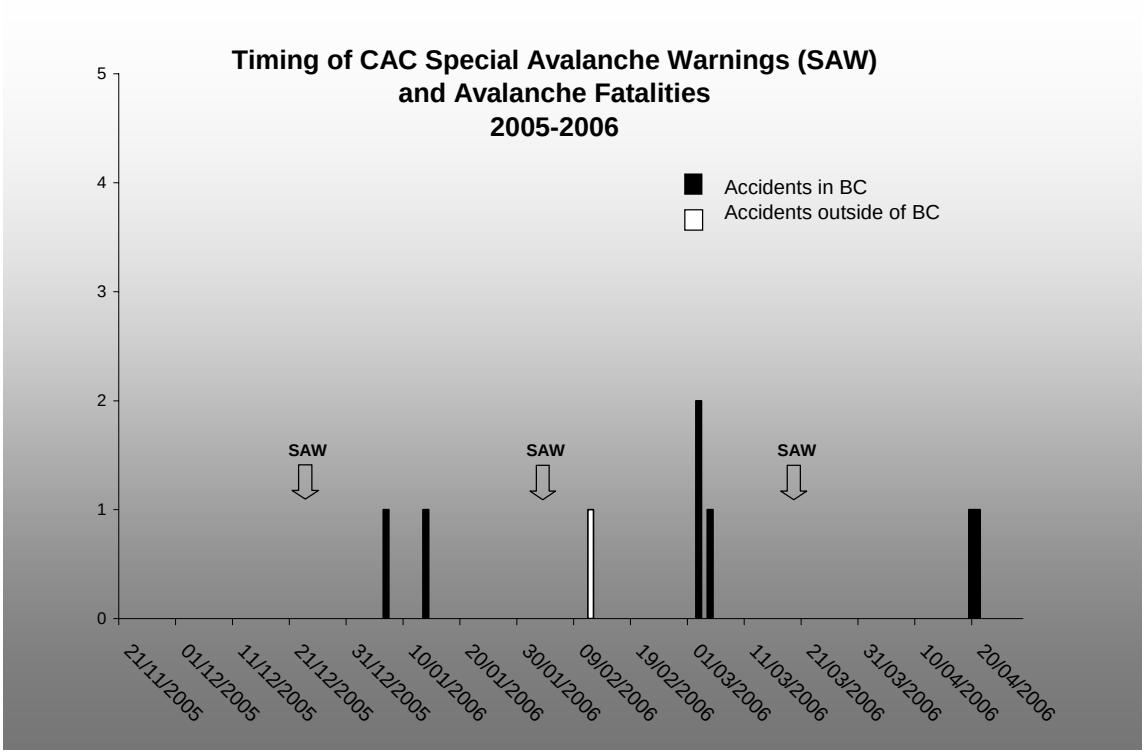

Figure 7. SAW frequency and avalanche accidents in 2005-06

6. FUTURE DIRECTIONS

6.1 Testing hypotheses and supplying scientific rigour

Many of the assumptions in the Special Avalanche Warning program are based on empirical data and expert opinion. Evolution of the program should target a more analytical examination of the factors surrounding increased frequency of avalanche accidents. To this end the CAC is hoping to engage the interest of an educational institution in examining SAW inputs, developing hierarchies and producing a SAW matrix or decision aid for use by the CAC forecast team.

6.2 Extending the footprint of the Special Avalanche Warning Program

Currently the SAW program is a cooperative venture between PEP and the CAC covering seven avalanche information regions in British Columbia. It is the intention of the CAC to work with partner agencies and land managers to expand the program to additional areas and jurisdictions.

7. CONCLUSION

The Provincial Emergency Program views the Special Avalanche Warnings as being consistent with the approach of raising awareness of impending increased threat, similar to wildfires and flood, with similar positive results.

The CAC views Special Avalanche Warnings as an integral part of the suite of avalanche safety products offered to the public, but also as an opportunity to interact with the media to leverage avalanche safety messaging and help them develop appropriate and informed stories related to avalanche risks.

Special Avalanche Warnings also build avalanche safety community links and encourage exchange of pertinent avalanche information.

8. ACKNOWLEDGEMENTS

Many thanks to the staff of the Emergency Coordination Centre at the British Columbia Provincial Emergency Program, and the forecast team at the Canadian Avalanche Centre: Alan Jones, Karl Klassen, Greg Johnson, Evan Manners.

9. REFERENCES

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