

WEB BASED DISPLAY OF AVALANCHE EVENTS USING GOOGLE MAP APPLICATION PROGRAMMING

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ABSTRACT: Recent avalanche activity is a prime indicator of the current avalanche hazard. Knowledge of recent avalanche events and the attributes of the terrain where they occurred help experienced users make good decisions. To provide this information to the public, the Bridger-Teton National Forest Avalanche Center used the google map application interface and Geographic Information System technology to display avalanche events in a simple, user friendly, web based format. The locations of avalanche events are displayed upon topographic elevation contour map and aerial photography backgrounds. Users can pan and zoom in on these locations. Options allow for the selection of date ranges, and to view avalanche events that occurred in the backcountry or at local ski resorts. The table format option lists details about each avalanche and terrain attributes which include the starting zone aspect, elevation and steepness. This application also sorts and displays multiple avalanche events by any of these parameters. This new product was a huge success. It greatly increased the quality and quantity of avalanche observations to our forecast center and was well received by our users as a way to view this important information.

1.0 INTRODUCTION

The Bridger-Teton National Forest Avalanche Center has issued daily avalanche hazard bulletins since the mid 1970's. The mission of the center is to provide the information necessary for users to make good decisions regarding travel in avalanche terrain. Recent avalanche activity is one of the best indicators of the current avalanche hazard. Timely knowledge of recent avalanche events, including details regarding the attributes of the avalanches and the terrain where they occurred, should help experienced users make good travel decisions.

2.0 WEBSITE AVALANCHE EVENT MAPPING

Extensive snow and avalanche information is posted daily on the avalanche center's website located at jhalavalanche.org. During the summer of 2009 the ability to post and view avalanche events using a google map application interface and Geographic Information System Technology was developed. This product was operational during the 2009/10 season.

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2.1 Avalanche database

Critical information regarding avalanche events reported to the center is entered into a SQL server database. The avalanche data includes the date, time, path name, trigger mechanism, destructive size, relative size and crown depth. Terrain attributes include starting zone elevation, aspect and steepness. This database also includes fields for notes on each avalanche and the ability to designate whether each event occurred in a ski resort or in the backcountry and if so, in which of our backcountry zones.

2.2 Posting avalanche events

After the attributes of avalanche events have been entered into the database the information is uploaded into the avalanche event map section of our website. Pan and zoom tools in the administrative section of the google map programming application are then used to locate the position of each uploaded avalanche event in the map view section of the website.

Sometimes the initial reports of an avalanche event lack information or have erroneous content. If additional or better information becomes available it can be uploaded to replace the original information. If the location is not known or vague, that status can be posted in the notes field.

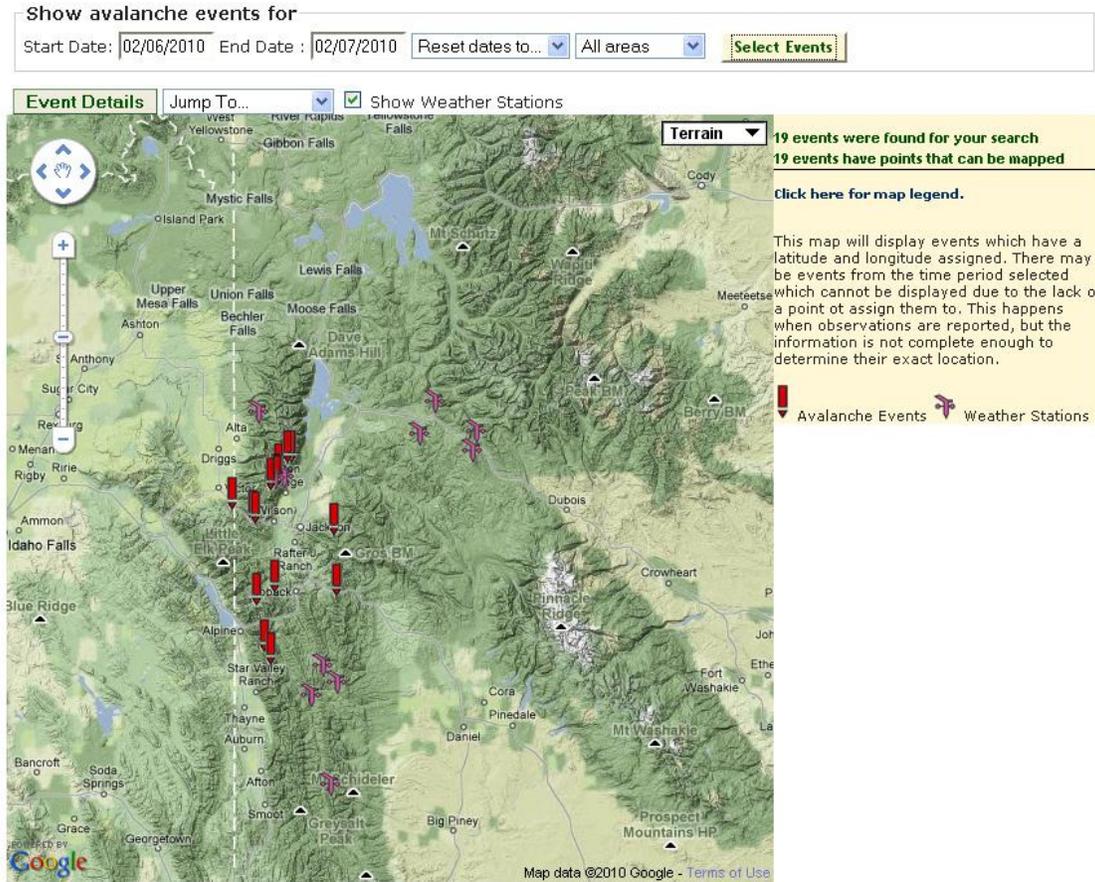


Figure 1: Map view of posted avalanche events that occurred on February 5 & 6, 2010.

2.3 Viewing avalanche events

The public can view posted avalanche events by going to the Avalanche Event Map section of the Avalanche Information Menu of our website. Information regarding avalanche events can be viewed in either the map view (default setting) or in the event details (table view) setting (Figures 1 & 2). The event details/map view button switches between the map view and table view screen displays.

In either mode the viewer can select the date range for the avalanche events to be displayed. The default setting displays the avalanche events posted for the most recent seven days. A pull down menu allows the viewer to set this display for the last two weeks or the last month. Start and end day calendar fields enable the viewer to select a date range as short a single day or for any number of consecutive days.

Another pull down menu allows the viewer to display all avalanche events (default setting) for the time period selected or choose to display avalanche events that occurred only in the backcountry or only at ski resorts.

If a viewer selects a date range other than the default setting, then they must click on the select events button to activate the selected non-default date range. The same applies if the viewer wants to only view events that occurred in the backcountry or at a resort. They must click on the select events button after choosing either backcountry or ski areas from the pull down menu.

2.3.1 Map View

The map view is the default setting when a viewer goes to the Avalanche Event Map section of our website. The following features are available on the map view screen.

Number of Events

This feature is located in the upper right portion of the map view screen. It displays the number of avalanche events that have been posted for the date period selected by the viewer. It also displays the number of those events that have a location that is designated on the map view screen.

2010 International Snow Science Workshop

Show avalanche events for

Start Date: 02/06/2010 End Date: 02/07/2010 Reset dates to... All areas Select Events

Map View Map Selected Rows

Show 25 entries Search:

Date	Time	Pathname	Type	Trig	Rel. Size	Des. Size	Dpth	Aspect	Elev	Slope Angle	Zone	Notes
02/07/2010		red Creek Drainage	SS	AS	3	3.0	36	E	7700	31-35	303	
02/07/2010	08:00:00	Wimpy's Knob SE Drainage						SE	9000	36-40	105	<<Size, type, trigger, and exact date of occurrence unknown.>>
02/07/2010		Albright S Bowl		N				S	10000	36-40	105	<<Size, type, and exact date of occurrence unknown.>>
02/07/2010	08:00:00	Wolf Mountain	SS	AS	3	2.0	18	NE	8500	31-35	304	<<Sixth skier on a slope.>>
02/07/2010	08:00:00	Avalanche Bowl	SS	AS	2	2.0	18	NE	8800	31-35	104	<<Skier skied out of slide, uninjured.>>
02/06/2010	08:00:00	Gros Ventre NE 9760	HS	AS	3	3.0	48	NE	9760		203	<<Remotely triggered by party of five on a nearby knob. Smaller slide went over a cliff and released a larger slide below.>>
02/06/2010		Mount Oliver North Gully	SS	AS	2	2.0	18	N	8000	36-40	104	<<Reporting party did not see event. Possible natural trigger. Exact location not determined.>>
02/06/2010		North Fork Murphy Creek	HS	AV	3	3.0	48	NE	8700	41-45	305	<<Snowmobiler fatality.>>
02/06/2010	15:30:00	Murphy Lake Area	HS	AV	2	2.0	36	NE	7000	36-40	305	<<Snowmobiler deployed air bag, buried up to their goggles.>>
02/06/2010	14:15:00	Beaver Mountain	HS	AS	2	3.0	36	E	9000		303	<<Remotely triggered>>
02/06/2010	16:30:00	Christmas Tree Bowl	SS	AS	2	2.0	18	NE	9000	36-40	104	<<Triggered by third skier on the slope.>>
02/06/2010	08:00:00	Cody Above Powder 8 Bowl	L	N	1	1.0	6	NE	10500	41-45	105	
02/06/2010	08:00:00	Mt Hunt East Bowl	L	N	1	1.0	6	SE	10200	36-40	105	
02/06/2010	08:00:00	laramie4	SS	AB	1	1.0	5	E	9700	36-40	JHMR	
02/06/2010	08:00:00	laramie3	SS	AE	1	1.0	5	E	9700	41-45	JHMR	
02/06/2010	08:00:00	laramie2	SS	AE	1	1.0	5	E	9700	41-45	JHMR	
02/06/2010	08:00:00	laramie1.5	SS	AE	1	1.0	5	E	9700	41-45	JHMR	
02/06/2010	08:00:00	unskiable	SS	AB	2	2.0	8	NE	9000	36-40	JHMR	
02/06/2010	08:00:00	hangingrock	SS	AE	2	2.0	8	SE	10000	36-40	JHMR	

Showing 1 to 19 of 19 entries

Figure 2: Table view of posted avalanche events that occurred on February 5 & 6, 2010.

Pan & Zoom

Pan and zoom tools located on the left side of the display enable the viewer to zoom and pan the map view screen.

Change Map Style

A pull down menu is located in the upper right portion of the map view screen to the left of the event number display. This menu allows the viewer to change base map styles. Selection options include map, satellite, hybrid or terrain base map styles. The terrain base map is the default setting. The pan and zoom tools function in all of the base map styles.

Avalanche Marker Data Display

On the map view screen, a user can view selected information about a particular avalanche event by clicking on that event's marker (Figure 3). The information displayed (if available) includes the date and time of the event, the avalanche path name, the avalanche type, its relative size, its trigger, crown depth and the starting zone aspect and elevation. The avalanche type, size and triggers are designated by a number or two letters. A legend which provides definitions of these designations can be viewed by clicking on the "click here for map legend" button located beneath the number of events display.



Figure 3: Avalanche Marker Display

2.3.2 Events Details (Table View)

The events details button allows the user to switch back and forth from the map view to the table view. The table view displays the avalanche data for the date period selected in a table format. The default setting lists the ten most recent avalanches with the most recent at the top of the table. A display in the lower left portion of the table notes how many avalanche events are displayed with respect to how many events exist for the days selected. Navigation buttons in the lower right portion of the screen allows users to view the rest of the events. A pull down menu below the map view button allows the viewer to display 25, 50 or 100 entries in the table format.

The data listed for each entry (if available) includes date, time, pathname, type, trigger, destructive size, size relative to the path, crown depth in inches, starting zone aspect, starting zone elevation, starting zone steepness, its zone within our forecast areas and notes about the event.

Sorting

The table view default setting sorts the entries by date. Sorting of the data in any of the table columns headings is possible by clicking on the gray arrows to the right of the column headers. One click sorts the entries for the time period selected for that attribute (destructive size for example) from smallest to largest. A second click sorts from largest to smallest.

Search

A search function field exists in the upper right portion of the table view screen. This tool can be used to list the entries by name, aspect, size, date, zone, etc. Clearing the search field returns the viewer to the original pre-search list of entries.

Map Selected Row

The map selected row feature enables the user to select one or multiple events in the table view by row, and then view their location on the map view screen. Users can select one or multiple entries by row on the table view screen and then click on the "map selected row" button. The map view screen with the location of the selected event(s) will appear automatically.

2.4 Additional features

Icons representing the location of remote automated weather stations operated by the avalanche center are displayed on the map view screen. These icons can be removed by unclicking the show weather stations box. The 5AM data from each weather station can be viewed by clicking on an icon.

2.5 Future improvements

New features and improvements are under development for this section of our website.

2.5.1 Mapping improvements

As google mapping program application evolves, new features will be incorporated into this program. The current program depicts avalanche events as a point in the map view. Future displays will delineate these events as polygons, when possible.

In the present configuration, avalanche events are reported to an avalanche specialist who enters the information into our database and then uploads the data and location of the avalanche onto our website. Programming is in process that will enable avalanche events to be entered at a remote location via our website by any person. Entries submitted by the public will be reviewed by one of the centers avalanche specialists before it is posted on our website.

Cluster markers will be developed for the map view screen to better display multiple avalanche occurrences (over time) in the same starting zone.

2.5.2 New features

In the future, this google map programming application will be used in a similar manner to display other useful snow and avalanche information.

Avalanche photographs

This program is being upgraded with the ability to post photographs of avalanche events for the 2010/11 season.

Snow pit profiles

The location of snow pit profiles will be displayed on the map view screen. A check box will be used to turn this display on or off. The existing map view tools and features (pan, zoom, time period selection, etc.) will be applied. Each snow pit location will link to a snow pit profile cached in another section of the website.

Avalanche fatalities

The location of known avalanche fatalities will also be displayed and be able to be turned on or off on the map view screen. These locations will interact with the avalanche fatality database section of our website.

Weather station data

Like the snow pit profiles and avalanche fatality locations the weather station icons depicted on the map view screen will be linked to other sections of the website that provide graphic displays of data from those stations.

Snow and weather observations

Snow and weather observations including avalanche warning signs like whoomping, cracking and the observation of fresh wind-blown snow deposits will be posted on our website in the future. This information also has the potential to interact with the avalanche events mapping section of our website.

3.0 CONCLUSIONS

Google map application programming was used by the Bridger-Teton National Forest Avalanche Center to display avalanche events on our website. This new product was well received by our knowledgeable users. It greatly improved the center's ability to convey important information regarding the location and attributes of avalanche events in a timely manner via a simple, user friendly, web based format.

Having this new product operational during the 2009/10 season greatly increased the quality and quantity of avalanche observations to the forecast center. Further development of this versatile tool is expected to increase the center's ability to interact with our users and provide critical avalanche information to the public.