

Using Google map application programming to communicate avalanche hazard from multiple avalanche centers

Robert H. Comey^{1*} and Carol Peck²

¹Bridger-Teton National Forest Avalanche Center, Teton Village, Wyoming

²Captivate Web, Jackson, Wyoming

ABSTRACT: In the United States (US) there are over 15 separate avalanche centers which operate independently and issue avalanche hazard bulletins for 55 areas in portions of nine states. Each center derives data from different sources, caters to different users, produces their bulletins in different formats and posts them on different websites. During the 2012/13 season a Google map format was used to display the daily avalanche hazard rating for these areas in one location. This programming can also be used to map the location of individual avalanches, weather stations, snow pit profiles and the location of avalanche fatalities. This project is designed for web browsers, which allows it to be easily linked to and embedded in other web pages. Several of the US centers have embedded the map to show their daily hazard ratings. In addition to the Google map interface, the project uses a best-of-breed open-source geospatial enabled database. These tools provide a robust platform that could be expanded to include avalanches centers in other countries.

KEYWORDS: Avalanche, Google Map

1.0 INTRODUCTION

There are over 15 separate avalanche centers in the United States. These centers operate independently and issue avalanche hazard advisories for portions of nine states and 55 specific areas within those states. These centers span four time zones and are located in Alaska, along the Pacific Coast, in the Rocky Mountains and in the northeast portion of the country near the Atlantic Coast.

Each center derives data from different sources, caters to different users, produces avalanche hazard advisories in different formats and post them on separate websites. This paper presents the results of an effort conducted during the 2012/13 winter season to display the avalanche hazard ratings produced by these independent centers on the internet in one location.

Before this effort was undertaken users were not able to visualize the daily hazard rating from multiple centers on one map

This Google map project was designed for web browsers, which allows it to be easily linked to and embedded in other web pages. Several of the nation's centers have embedded this map product into their websites.

2.0 AVALANCHE HAZARD RATING DISPLAY FOR MULTIPLE AVALANCHE CENTERS

During the 2012/13 season Google map application programming was used to display the daily avalanche hazard from multiple avalanche centers in the United States. This effort involved 10 centers with 50 separate forecast zones.

**Corresponding author address:* Robert H. Comey, Bridger-Teton National Forest Avalanche Center, Jackson, Wyoming, USA;
Tel: +1 307 690-4527;
email: comey@wyom.net

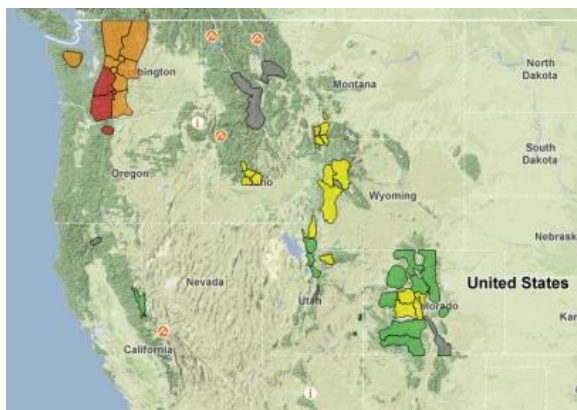


Figure 1. A screen shot of the daily avalanche hazard ratings posted by multiple avalanche centers in the western United States during the 2012/13 winter. In this display a low avalanche hazard rating is posted in portions of Colorado and Utah, moderate avalanche hazard ratings are displayed in portions of central Colorado, northern Utah, Wyoming, Montana and Idaho. Considerable and high avalanche hazards ratings are posted in portions of Oregon and Washington. All of these centers post their hazard ratings for these areas on a daily basis. The gray zones located in eastern Idaho and western Montana represent areas where the hazard rating is posted less frequently and had expired on the day of this screen shot.



Figure 2 Zoom and pan tools in the Google map application enable the user to visualize the daily avalanche hazard posted by any avalanche center who participates in this project. Avalanche centers that exist but have not yet been included in this program are represented by the orange circle icons. These icons provide links to those centers.

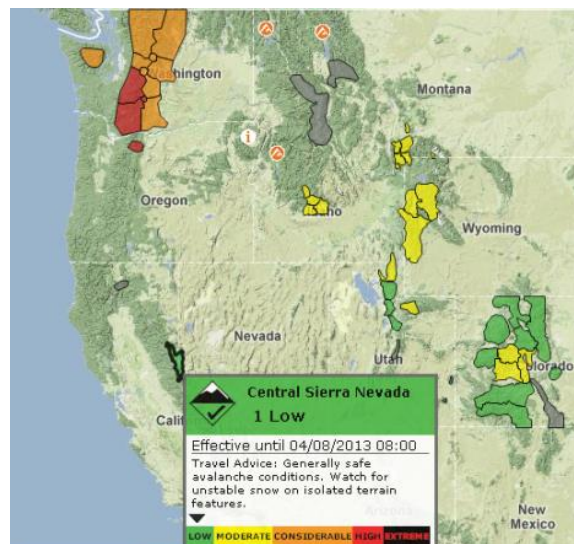


Figure 3 Information including the name of the avalanche center, travel advice for the that days avalanche hazard rating and the expiration time for that days hazard rating is displayed by moving a mouse over a forecast zone. A click on a zone will direct the user to the bulletin for that area.

The boundaries for each avalanche center's forecast areas are shared as a KML file and then saved as a polygon in a spatial database. For any particular one of these areas a center may issue different hazard ratings for various elevations or aspects or the hazard may be forecast to increase or decrease during the day. This mapping program displays the highest avalanche hazard rating for that area on a given day. In addition, only the current advisory is displayed. Once an advisory has expired – each center dictates the date and time of expiration – the map will show the area as grey indicating there is no currently active advisory.

For centers that use the Canadian Avalanche Association Markup Language (CAAML), after each daily advisory is posted on their own website, a CAAML file with the hazard rating is programmatically delivered ('pushed') and data is updated on the map. For centers that do not code their advisory data in CAAML, programming has been developed that goes to their websites on a timed interval to retrieve the latest advisory data and update the map.

This application has the capability to display the daily avalanche hazard rating for any avalanche center that has its forecast zone boundaries delineated and posts its advisory information on the internet.

Programming is in process for the 2013/14 season that will enable participating centers to display avalanche watches/warnings when they are in effect.

3.0 ADDITIONAL DISPLAY CAPABILITIES

The Bridger-Teton Avalanche Center (BTAC) located in Jackson Hole, Wyoming in the United States uses this Google Map application technology to display the location of avalanche events, snow pit profiles, automated weather stations, avalanche fatalities and the associated data. Date ranges for this display are defaulted to the most recent several days. Users can change the date range to view historical data.

3.1 *Avalanche fatalities*

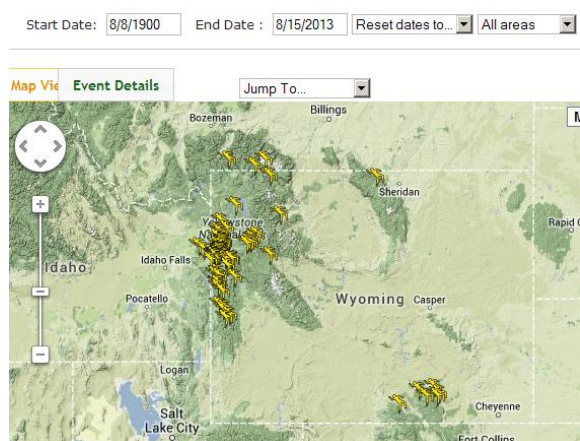


Figure 4 A screen shot that shows the location of 75 avalanche fatalities that occurred in the State of Wyoming during the past 100 years. Pan and zoom tools inherent in the Google map application enable the user to change the map scale. Details regarding each fatality can be obtained by clicking on an individual fatality icon. Links connect to articles and reports about each fatality and when available, Google Earth flybys over the fatality locations.



Figure 5 A screen shot which has been zoomed into the location of a single avalanche fatality that occurred on January 27, 2013. The display box appears when a user clicks on the fatality icon. It provides a quick summary of the fatality data and links to articles about the fatality and photographs. The Google map application allows the viewer to select different base layers options. In this image aerial photography is the chosen base layer. At this scale individual trees are clearly visible.

Programming is in process which will enable participating centers to post avalanche fatalities with a spatial element (a point) that occur in their forecast areas during the 2013/14 season. The point will enable fatalities to also be displayed on the map.

3.2 *Avalanche events*

For several years the BTAC has used this mapping technology to display individual avalanche events as they are reported or observed. These events can be entered or posted by the centers avalanche specialist or by the public. Public submittals are reviewed by the centers staff before they are approved for posting.

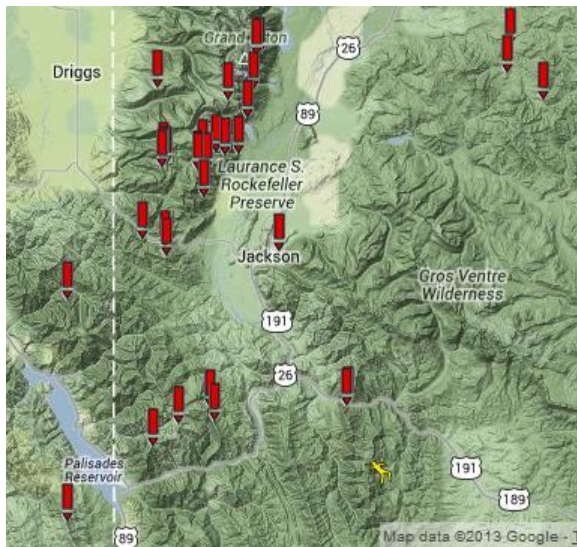


Figure 6 Screen shot of the location of individual avalanche events and one fatality that occurred in late January and early February 2013 in a portion of Western Wyoming. The red markers represent the location of individual avalanche events. The yellow marker represents the location of an avalanche fatality.

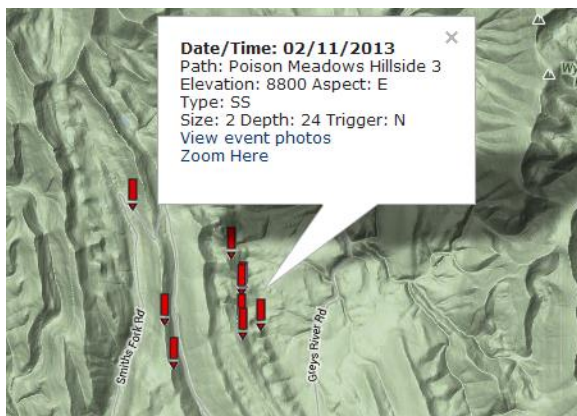


Figure 7 A screen shot that shows pertinent data regarding an individual avalanche event that has been displayed by clicking on that event's icon. This display box includes links to photographs of this event and a link that further zooms into this event's location. Additional details regarding this avalanche, including terrain attributes, avalanche parameters and notes can be accessed by visiting the table view function of this mapping application. A legend is provided for the abbreviations used in this display.

3.3 Snow Pit Profiles

This mapping application has also been used to display the location of snow pit profiles. Like the avalanche events and the avalanche fatalities,

these locations are marked by a distinct icon. The mapping program uses the most recent two weeks as the default setting for the location of these profiles. The user can select any date range to view older profile locations.

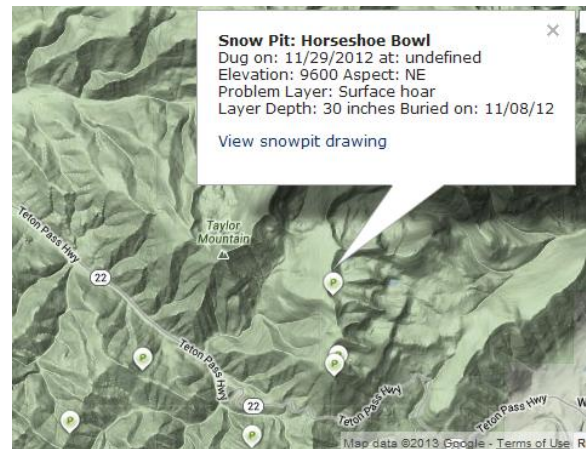


Figure 8 A screen shot that shows the locations of snow pit profiles conducted near Teton Pass during the period of mid November to Mid December 2012. The display box provides a short summary of the pit information and a link to the pit profile and additional detailed data.

3.4 Automated weather stations

This application is also used by the BATC to display the location of remote automated weather stations and the data from those stations.

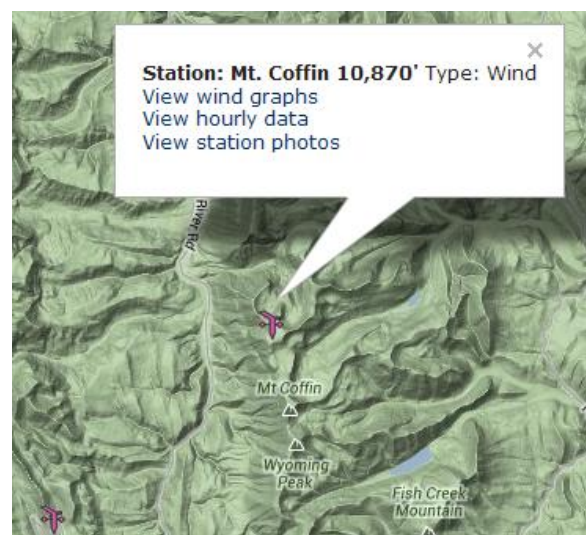


Figure 9 Screen shot of a weather station location and its display box with links to data from that station.

4.0 DISSCUSION

Google map application programming has been used by the BTAC for several seasons to depict the location of avalanche events, fatalities, snow pit profiles and automated weather stations. During the 2012/13 season programming was conducted that enabled ten avalanche centers in the United States to post the daily avalanche hazard rating for 50 separate areas using this Google map technology.

In addition to the Google map interface, the project uses a best-of-breed open-source geospatial enabled database. These tools provide a robust platform that could be expanded to include avalanche centers in other countries.

An example of this application can be viewed by going the home page of the BTAC at <http://www.jhavalanche.org/index.php>. Google maps tools available in the embedded map window can be used to zoom out and view the avalanche hazard ratings posted by multiple avalanche centers. If you hover over a delineated forecast area a display box will appear. During non winter times these forecast areas will be gray in color as the advisory for that area would have expired. If you click on an area you will be linked to that centers area advisory.

To view an example of how this technology is used by the BTAC to display avalanche events, fatalities, snow pits and weather stations go to the avalanche information pull down menu and select the avalanche events map option (<http://www.jhavalanche.org/eventmap/index.php>). Instructions for the operation of the avalanche event map functions are provided at http://www.jhavalanche.org/avalanche_information.php. You will need to select an appropriate data range and then hit the select event button to populate the map during non winter times.

This mapping program has been very popular with knowledgeable users during the past several seasons. Visits to some of the data linked to this mapping application increased up to 265% during the 2012/13 season.