Using raw LiDAR (Light Distancing And Ranging) data to identify trimlines in large avalanche paths

Christopher M. McCollister1,2 and Robert H. Comey1,2
1Bridger-Teton National Forest Avalanche Center
2Jackson Hole Mountain Resort

ABSTRACT: Raw LiDAR data was used to remotely sense trimline locations in large avalanche paths by determining the height of the young trees within the slidepaths. LiDAR is a remote sensing technique using the time lag of reflected laser pulses to determine the distance between a target and a source. These pulses reflect off any surface, including trees. This study uses Fusion to analyze the raw LiDAR data. Fusion is a very powerful software package created by Robert J. McGaughey at the USDA Forest Service’s Pacific Northwest Research Station. In addition to viewing the raw pulse data, this software allows users to analyze the quality of the raw LiDAR data, produce bare earth DEMs (Digital Elevation Models), create canopy surface and density models, calculate descriptive statistics, and convert data to other formats. Highly detailed, bare earth DEMs are one of the most common products of LiDAR data. In the summer of 2008, a LiDAR mission was flown for the southern Teton Range in western Wyoming, USA. This area contains many large avalanche paths. Fusion was used to create canopy height models from the raw LiDAR pulse data, and to convert these models into a format that could be analyzed in a Geographic Information System (GIS). In many large avalanche paths, multiple trimlines could be identified as new trees grow up after complete removal by historic avalanches, creating different age class stands corresponding to large historic avalanche cycles.

1 INTRODUCTION

LiDAR is a technique to determine distances by the time lag of a laser pulse reflected off of a distant target. When deployed by an aircraft this technique can create a highly detailed, three dimensional surface model of the pulses reflected off the surface of the earth (Figure 1). This raw LiDAR data can be used to create very accurate and precise bare ground DEMs, canopy surface models (CSM) and canopy height models (CHM). For more details on the application of LiDAR data for snow and avalanche research, see Deems (2006) and McCollister and Comey (2009).

In cooperation with the Bridger-Teton National Forest and Grand Teton National Park, the Teton Conservation District organized a LiDAR flight for the southeastern Teton Range in the summer of 2008. This poster uses some examples of canopy height models and canopy surface models to show multiple trimlines in large avalanche paths.

2 METHODS

Fusion was used to create canopy height and canopy surface models. Figure 2 shows a canopy surface model of Jensen Canyon. Using Fusion, a canopy height model was created for the same area. A canopy height model only shows the height of the canopy and does not include the underlying elevation. This dataset was converted to a grid format usable by ESRI’s ArcGIS 9.3 for further analysis (Figure 3).

3 RESULTS AND DISCUSSION

Figure 3 shows the canopy height model classified in groups of 0.5-2.5 m (orange), 2.5-5 m (green), 5-10 m (turquoise), 10-25 m (blue), and 25-60 m (red). Trimlines are easily identified in both the north facing avalanche path and the main canyon drainage.

REFERENCES
