Introduction

- An avalanche is one of the deadliest disasters a person can face when traveling on or near mountains or glaciers.
- In the U.S. alone, avalanches cause an average of 25 fatalities per year (34 last season), and many more injuries that may or may not have been reported.
- Any natural disaster is difficult to predict, but there are many complex variables that affect avalanche conditions, including weather, terrain, snow conditions, and human factors.
- This uncertainty makes avalanches especially difficult to model on a large scale or for variable conditions, which makes them harder to predict and avoid.

So how can we use GIS to estimate and convey avalanche danger effectively for a given region?

Utility

Possible uses of GIS for avalanche work include:

- Locating trigger zones by finding open areas that can support a high level of snow loading and are steep enough to start an avalanche.
- Modeling runout, or avalanche track, by creating a watershed-type map downslope from the trigger zones (extremely variable based on conditions and avalanche size).
- Recording locations of past avalanches for statistical use (ex. finding suitable locations for avalanche controls like cannons or snow fences).
- Displaying up-to-date avalanche forecasting and current risk levels in areas where snowpack and other variables are easily measured.

Methodology

To assess avalanche danger in a given region at any time, several types of data can be combined:

- Digital Elevation Model (DEM) and slope: important in determining areas prone to slope failure (most avalanches occur at slopes over 35°), as well as slope aspect (for estimating wind loading) and for runout modeling.
- Land Use: Forested or developed areas are generally low-risk areas for avalanches.
- Proximity of hazard areas to points of human contact: trails, roads, hiking routes, etc.
- Snowpack characteristics: Depth, density, slab width, etc.- observed or estimated by meteorologic data.
- Other useful data: Past avalanche events and conditions, locations of snow fences, barriers, etc.

These layers can be combined using GIS tools to create visually accessible warning maps for climbers, skiers, hikers, etc.

Findings

By using GIS data in conjunction with other factors, it is possible to accurately estimate avalanche risk on a given slope, and thereby inform people exactly which areas are most dangerous. Highlighting on a map which areas are at risk is much more effective than an general warning level.