SNOW GLIDING ON STEEP ROCK COQUIHALLA, B.C.

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INTRODUCTION

The new Coquihalla highway traverses the avalanche prone Cascade Range through Southwestern British Columbia. The terrain above the highway has extensive areas of steep rock slabs which promote rapid snow gliding (slip of the entire snowpack over sloping ground) and full-depth avalanche formation. These avalanches release frequently as a result of the interaction of water (from melt or rain) and the ground roughness topography. Observations and measurements show that these avalanches can release during clear cold weather when slab avalanches would not normally be expected. By measuring snow gliding, temperatures, snowpack properties and avalanche occurrences for three winters, we have shown that a comprehensive strategy for full-depth avalanche prediction in the area will require measurements of gliding (or a similar index of deformation at the snow-rock interface). This is due to the indirect temporal correlation between the air temperature , melt or rain occurrence and the gliding rates.

EXPERIMENTAL METHOD

Our measurement method involves using glide displacement gauges (3 meter maximum displacement) similar to those described by in der Gand and Zupancic (1966). During the fall of 1987, we installed 5 gauges on a rock slab at 1450 m elevation on a south facing slope with 31^0 inclination. The site is characterized by a step in the rock below which the snowpack separates from the rock to form a slab. The site was chosen to be steep enough that gliding is representative of adjacent starting zones but not steep enough that avalanches would occur at the site.

Supporting measurements at the site include: temperatures at the snow-rock interface, air temperature above the snowpack surface and air temperature between the rock step and the snowpack (indicative of temperatures in a "glide crack"). All temperature measurements were made with thermistors. Snow gliding measurements

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and temperature measurements were made at ten minute intervals throughout the winter. These data were recorded by a data logger at the site connected to a radio and modem accessible from a personal computer at a base station below. We also maintained a complete record of snowpack properties by making snow profile observations at two week intervals throughout each winter.

RESULTS

Our main results may be summarized as follows:

(1) The range of snow gliding rates at each measurement location is consistent from year to year, dependent on local ground roughness and position with respect to the step in the rock (glide crack). The range of gliding rates observed increases in the downslope direction from gauge #1 (above the step in the rock) to gauges #2 and #3 (just below the step and in the middle of the slab, respectively). Maximum glide rates are approximately 100 mm/day below the step and total displacement is about 2.5 m. per year.

(2) Glide rates generally correlate with air temperature: higher glides rates are usually associated with warmer temperatures but this is not always the case.

(3) No consistent pattern for correlation of day and night glide rates is evident: on a seasonal basis, average glide rates measured during the day may or may not be faster than night values.

(4) Avalanche occurrences generally coincide with either warm temperatures, fast gliding rates or both (particularly in spring). On approximately 40% of the days with full-depth avalanche occurrences during 1989-90 the maximum air temperature in the area did not reach 0^{0}C during the time when avalanches were observed. This shows that air temperature and rainfall records are not sufficient for prediction of full-depth avalanches in the area: gliding measurements (or other measurements providing a suitable index of gliding) will be required for comprehensive forecasting. Full-depth avalanches often release unexpectedly based on temperature considerations. However, our data show peaks in glide rates concurrent with these unexpected events [when cold (below 0^{0}C) temperatures prevail].

REFERENCE

in der Gand, H.R. and M. Zupancic, 1966, "Snow Gliding and Avalanches," IASH Publication No. 69, 230-242.