Geophysical Research Abstracts,
Vol. 11, EGU2009-12945, 2009
EGU General Assembly 2009

Debris flow hazards and risks on Cheekye Fan, British Columbia

M. Jakob
(mjakob@bgcengineering.ca), BGC Engineering Inc,, Vancouver, Canada

Natural hazard and risk assessments hinge fundamentally on a detailed understanding of the relationship between frequency and magnitude of the hazardous process under investigation. When information is sought from the deep past (i.e. several thousand years), continuous event records do not exist and the researcher has to rely on proxy data to develop the F-M model. Such work is often prohibitively expensive and few well researched examples for mass movement are available worldwide. Cheekye fan is a desirable location for land development and has a depth and breadth of previous research unprecedented on any debris flow fan in Canada. We pursued two principal strains of research to formulate a reliable frequency-magnitude relationship. The first focuses on stratigraphic analyses combined with radiometric dating and dendrochronology to reconstruct a comprehensive picture of Holocene debris flow activity. The second approach examines hydrological limitations of rock avalanche evolution into debris flows through either entrainment of saturated sediments or by failure of a landslide-generated dam and upstream impoundment. We thus hypothesize that debris flows from Cheekye River can be separated into two quasi homogenous populations: those that are typically triggered by relatively small debris avalanches, slumps or rock falls or simply by progressive bulking of in-stream erodible sediments; and those that are thought to result from transformation of rock avalanches. Our work suggests that debris flows exceeding some 3 million cubic metres in volume are unlikely to reach Cheekye fan due to limited water available to fully fluidize a rock avalanche. This analysis has also demonstrated that in order to arrive at reasonable estimates for the frequency and magnitude of debris flows on a complex alluvial fan, significant multidisciplinary efforts are required. As a second step in the analysis, we model the design debris flow using a two-dimensional debris flow runout model. Geomorphic evidence suggests that the flow occurred in two distinct rheologic phases, which necessitated splitting the model into a more viscous initial surge and a less viscous hyperconcentrated flow phase. This model separation achieved good agreement with the observed behaviour of a 2 million cubicmeter flow that occurred some 800 years ago. The final step in the analysis included a quantitative risk assessment of debris flows for highway users to the resort of Whistler and the proposed development. This analysis allowed specific design of debris flow mitigation to reduce risk to tolerable limits.