Computer-Assisted Identification of Potential Avalanche Terrain

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Abstract

It has long been recognized that the terrain upon which a snow cover is deposited plays a crucial role in snowpack stability later in the season. Therefore, an analysis was undertaken seeking to identify potential starting zones based solely upon terrain data. A Geographic Information System (GIS) was selected to assist in this analysis and data input to the system was limited to remotely-sensed and standard map products amenable to computer processing. The objective was to allow large areas to be quickly evaluated for avalanche potential with a minimum of human intervention and historical avalanche records. A 9 x 12 kilometer area centered around Berthoud Pass, Colorado was chosen as the study area due to the large number of accessible avalanche paths and the long history of observation there. A generalized model was created by a weighted overlay of slope, aspect, and elevation. The weighting factors, reflecting each variable's relative importance in avalanche initiation, were refined by an iterative trial and error process. The relative importance for the three layers was found to be 5, 2, and 1 for slope, elevation, and aspect respectively, however each category within the layers was also weighted. The overlay product was then reclassified into high, medium, and low potential and masked by a vegetation map thus eliminating from consideration all areas classified as forested. Verification and calibration of the model were accomplished by a comparison of the spatial coincidence of the areas predicted to be of high avalanche potential with the known starting zones in the study area. Overall, 43% of the known starting zones areas were classified by the model as high potential, 42% as medium, and 15% as low potential. Further refinement and testing are required before the model is ready for operational use, but the initial results are definitely promising.

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