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Variations in snow strength and stability on uniform slopes

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ABSTRACT. This research investigated whether single snowpits could reliably represent snowpack strength and stability conditions throughout apparently 'uniform' slopes. Seven slopes were selected by experienced avalanche forecasters, three each in the Bridger and Madison Ranges of Southwest Montana (U.S.A.), and one in the Columbia Mountains near Rogers Pass, British Columbia (Canada). Teams performed ten quantified loaded column tests in each of five snowpits within a 900 m^2 sampling site on each 'uniform' slope, measuring shear strength in a single weak layer. Collection of slab shear stress data enabled the calculation of a stability index, S_{QLCT}. Altogether, eleven trials were performed during 2000/2001 and 2001/2002, testing several weak layer types exhibiting a wide range of strengths. Weak layer strength and slab stress conditions varied widely across the sampling sites, with coefficients of variation in weak layer shear strength ranging from 10% to 50%, coefficients of variation in shear stress from 2% to 48%, and stability indices ranging from 1.8 to 5.7. Of the 54 snowpits completed, 10 pits were empirically rejected as unrepresentative of the stability index at their sampling sites. Of the remaining 44 statistically analyzed pits, 33 pits were statistically representative of their site-wide stability index, and the other 11 pits were found statistically unrepresentative of their site. All five snowpits at a site were statistically representative of their site-wide stability index in three of the eleven trials. The frequent inability of single pits to reliably represent stability on those eleven 900 m^2 sampling sites, located on apparently 'uniform' slopes, highlights the importance of improving our understanding of the processes affecting the variability of snowpack stability on any given day and the uncertainties associated with 'point' stability data.