Deriving Spatial Stability Variations From Penetration Resistance Measurements

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Spatial variations of weak layer and slab properties affect snow slope stability. To quantify spatial variability at the slope scale, penetration resistance was measured with a high resolution snow-micro penetrometer (SMP) in a partly randomized grid pattern. The design consisted of 46 measurement locations and was optimized for geostatistical analysis. In addition, a full snow profile and 20 compression tests were performed within the grid. Stability test results were compared to stability information derived from the SMP signal using a recently developed algorithm. A dataset consisting of five grids done fort-nightly on a southwest facing slope was analysed. A layer of facets was the predominant weak layer and was identified by the algorithm in most cases. The stability patterns derived from the compression tests were mostly reproduced by the stability formulation of the algorithm. Changes of slab properties seemed to be a major cause for changes in slope stability over time. The spatial stability variation was derived from a indicator semivariogram. Based on the resulting range and nugget ratio a scheme for estimating slope stability was proposed.