Predicting the Fracture Character of Potential Weak Layers in Penetrometer Signals

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Digital penetrometers have been shown to provide reliable assessments of snow hardness with depth; however, extracting useful information from the signals relating to stability has proved to be challenging. A scheme for predicting the fracture character of potential weak layers from penetrometer signals is developed. When a two-group classification between sudden (Q1) and other fracture character groups is performed, potential failure layers are correctly classified 80% of the time. The variables offering the best discrimination between sudden and other categories are weak layer thickness, average force gradient above the weak layer and, interestingly, both the average and the maximum force gradient below the weak layer. By itself, the fracture character prediction scheme is of limited practical use, since it requires the depth of the potential failure interface to be identified. However, we discuss how a weak layer tracing algorithm could be used as the basis for an operational model to detect weak layers from penetrometer profiles. By using the weak layer detection model in conjunction with the fracture character prediction, rapid, automatic identification of critical weak layers becomes possible.