Evaluating the Importance of Crystal-Type on New Snow Instability: a Strength vs. Stress Approach Using the SNOSS Model

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Understanding new snow instability is the key factor in predicting the release of direct action avalanches during storm cycles. The compaction rates, shear strengths and densities of various crystal-types were experimentally measured during a two winter field project in the Cascade Mountains of Washington State.

Cold-type crystals, such as bullets and sideplanes, showed relatively high density rates and moderate shear strengths. In contrast, warmer-type, dendritic crystals, such as dendrites and stellars, exhibited low shear strengths at very low densities. Warmer, non-dendritic types, such as needles and sheaths, were found to have moderately high densities and low to moderate shear strengths. Riming increased the density and shear strength of a given crystal type.

The SNOSS model has been developed as a tool in forecasting these types of avalanches but the model's present form does not incorporate crystal-type in its stability calculations. Our measurements show that the SNOSS model could be improved by adding crystal-type factors to initial density calculations and possibly to shear and densification rate equations as well.

New mesoscale weather forecast models which incorporate crystal habit parameterizations have the potential to greatly improve the forecasting of direct action avalanches when combined with a SNOSS-type stability model.