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Field and analytical examination of near-surface facets

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North- and south-facing field research locations were established that included meteorological stations coupled with daily observations and grain-scale images of the upper few centimeters of the snowpack. In three seasons, 47 near-surface facet events at the south-facing station were recorded. Statistical analysis of these events indicated two factors were related to facet formation: incoming short-wave radiation and relative humidity. Using a thermal model, variance-based sensitivity analysis, and Monte Carlo simulations the environmental conditions and snow material properties that lead to radiation-recrystallization were explored analytically. Based on the presence of specific temperature profiles that are understood to lead to facets, eight terms were determined to be influential in facet formation, which were further reduced to thermal conductivity and a dimensionless term, Ω, defined as the ratio of absorbed short-wave to long-wave radiation. Using these parameters, a graphical means for predicting the presence of near-surface facets is presented. Predicting the presence of near-surface facets may be possible with meteorological and basic snowpack information.