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Near-surface faceted crystals formed by diurnal recrystallization: A case study of weak layer formation in the mountain snowpack and its contribution to snow avalanches

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ABSTRACT. In the winter of 1995-96 we investigated the temperature and vapor pressure gradient conditions associated with the formation of faceted crystals that develop in the upper levels of the snowpack due to diurnal recrystallization. We used an array of six thermocouples connected to a datalogger to continuously measure snow temperatures in the region from 0.005 m above the snow surface to 0.20 m below the snow surface. Measurements during clear sky conditions in March showed temperature gradients in excess of $200^{\circ}\text{C m}^{-1}$ at night in the top 0.05 m of the snowpack, with the temperature gradient shifting direction and exceeding $100^{\circ}\text{C m}^{-1}$ through this layer during the day. These temperature gradients resulted in vapor pressure gradients which exceeded 25 mb m^{-1} during the day and at night. During this time, a significant weak layer of 1 mm faceted snow formed within 36 h. Widespread avalanche activity occurred for up to 9 d after this layer was buried by 0.50 m of snow.