

Predicting wet snow avalanches at the Arapahoe Basin Ski Area

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Premature terrain closures, due to wet snow instability, lead to unhappy skiers during the annual snowmelt period. Furthermore, wet snow avalanches are destructive and remove the snowpack from ski runs. Previous research shows that wetting fronts which infiltrate a continental snowpack for the first time result in a sudden loss of snowpack strength. Therefore, wetting fronts that penetrate the ski-compacted slab and underlying depth hoar are central to predicting wet snow instability. To investigate this concept, wetting front characteristics have been measured with dielectric probes. The study site is situated on a north aspect in an avalanche start zone that also serves as a ski run. Integrating these measurements with standard weather and snowpack observations indicate that the most important forecast parameters are: (1) Air temperature (2) Crack propagation pathways (3) Depth hoar texture (4) Ice structure characteristics (5) Radiation and (6) Snowpack temperature. For example, the first wetting fronts that fully penetrate the snowpack require air temperatures in excess of 15° C, total daily solar radiation near 32 MJ and a snowpack at 0° Celsius. Also, ice bodies that signify vertical migration of meltwater over broad areas are an important indicator of potential wet slab instability. Now forecasters supplement conventional avalanche forecasting skills with analysis of wetting front characteristics that indicate an impending loss of snowpack strength. Thus, steep terrain closures are based, in part, on predicting the concentration and timing of diurnal wetting fronts which rapidly infiltrate the ski-compacted slab and underlying depth hoar.