

Mapping of Snow Transition Zones in the Colorado Front Range

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Abstract. The Colorado Front Range depends on snowmelt to provide water for industrial, municipal, and agricultural needs. Snow accumulation in the Front Range tends to stratify by elevation, with warmer, lower elevations tending to exhibit intermittent zone snow which melts quickly at the start of the ablation period, and colder, higher elevation persistent snow zones which typically maintain snowpacks much later and a transitional snow zone which lies in between. This transitional snow zone may be particularly sensitive to changing climate conditions. Snow covered area is an easily obtainable measurement that can help identify the locations and elevations of these transitional zone. This study characterizes the snow covered area (SCA) depletion patterns during the ablation period for 2000-2010 using the Moderate-Resolution Imaging Spectroradiometer (MODIS) snow covered area product, which shows maximum snow extent for 8 day time intervals. The first objective of the study is to determine the elevation range of the transitional snow zones. For 100m elevation bands within 38 sub-basins of the Colorado Front Range, the dates of 25, 50, 75 and 98% SCA depletion are used to differentiate between intermittent, transitional, and persistent snow zones. Intermittent snow zones are characterized as those which have earlier dates of melt initiation, defined as the date of 25 % SCA depletion, and short ablation periods. Persistent snow zones have late melt initiation and short ablation periods. Transitional snow zones are areas at elevation in between, which exhibit early melt initiation and long ablation periods. After defining transitional zones, the December –August minimum and mean temperatures of these zones are mapped using the Parameter- elevation Regressions on Independent Slopes Model. Results provide a series of maps delineating areas of persistent snow, intermittent snow, and the elevations/areas of transitional snow, as well as the minimum and mean monthly temperatures at which the transitional snow zones exist.