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Remote Sensing of Snow in the Cariboo Mountains of British Columbia, Canada

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This presentation will review some recent work examining the validation and application of remote sensing snow products in the Cariboo Mountains of British Columbia, Canada. Various remote sensing products are utilized to investigate snow distribution, duration and accumulation in the region. We will first introduce Moderate Resolution Imaging Spectroradiometer (MODIS) 8-day maximum snow cover extent products (MOD10A2) from 2000-2007 that are filtered to reduce cloud coverage and evaluated with ground-based snow measurements. The resulting data are used to monitor snow cover duration (SCD) and snow cover fraction (SCF) in the Cariboo Mountains where elevations range from about 500 m to 3000 m above sea level. Elevation, slope, and aspect greatly influence the distribution and duration of snow cover in the watershed. For instance, the gradient of SCF with elevation (d(SCF)/dz) during the snowmelt season is 8% (100 m)$^{-1}$. The average ablation rates of SCF are similar for different 100 m elevation bands at about 5.5% (8 days)$^{-1}$ for altitudes $<$ 1500 m with decreasing values with elevation to near 0% (8 days)$^{-1}$ for altitudes $>$ 2500 m where perennial snow and glaciers dominate the landscape. We will then discuss brightness temperatures (TB) from the Special Sensor Microwave Imager (SSM/I) and Advanced Microwave Scanning Radiometer (AMSR-E) from 2003-2007 that are utilized to retrieve and evaluate the snow water equivalent (SWE) over the Cariboo Mountains. Various algorithms including the Environment Canada (EC) algorithms, the spectral polarization difference and an artificial neural network for both SSM/I and AMSR-E are evaluated against in-situ SWE observations by several statistical metrics. The results show that the EC algorithms developed specifically for the southern prairies and boreal forest of Canada perform poorly across the complex topography and generally deep snowpack of the region. For other frequency combinations of SSM/I and AMSR-E measurements, significant relationships between TB difference and in-situ SWE exist only when it is less than a threshold of 250 mm or 400 mm, depending on the site. This study thus demonstrates the potential usefulness as well as some limitations of applying remote sensing products to monitor snow distribution, duration and accumulation in the Cariboo Mountains.