Passive Microwave Remote Sensing of Colorado Watersheds using Calibrated, Enhanced-Resolution Brightness Temperatures (CETB) for Estimation of Snowmelt Timing - CLPX and SnowEx

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ABSTRACT

Understanding the timing of seasonal melt onset is critical for water resources management in snow-dominated watersheds. Passive microwave remote sensing has been used to detect melt-freeze events with the Special Sensor Microwave Imager (SSM/I) and the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) with global coverage. This study investigates the newly available passive microwave calibrated, enhanced-resolution brightness temperature datasets (CETB) produced at the National Snow and Ice Data Center to estimate melt timing at higher spatial resolution (~3 km). CETB datasets generated from SSM/I and AMSR-E are used to characterize snowmelt timing in mountainous Colorado basins that were part of NASA’s Cold Land Processes Field Experiment (CLPX 2002-2003) and SnowEx 2017 campaigns. We employ existing algorithms using the diurnal amplitude variation (DAV) and cross-polarized gradient ratio (XPGR) methods at 36 GHz and 18 GHz to detect seasonal melt onset date and early season melt occurrences. Comparisons of algorithm results with ground observations determine the optimal melt onset algorithm thresholds for the newly processed data. We show that the higher-resolution datasets yield an improvement in snowmelt detection in landscapes with heterogeneous topography and land cover. This work provides insight into the performance of higher-resolution reprocessed CETB data for snowmelt analysis and will enable hydrologists to better analyze the characteristics and implications of snow melt in mountainous watersheds.

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