Refining and Automating DAV Snow Melt Algorithms using Passive Microwave Calibrated Enhanced-Resolution Brightness Temperature (CETB) Data in Alaska Watersheds

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ABSTRACT

Snowmelt is vital in snow-covered regions as it provides water for groundwater recharge, agriculture, industry, and domestic use. Understanding the timing and magnitude of snowmelt is essential for the water cycle, seasonal distribution of runoff, and disaster management (wildfire and flooding). For years, passive microwave (PMW) brightness temperatures (Tb) have been used to identify melt-freeze dynamics in snowpack. Liquid water in snow causes an increase in emissivity, drastically increasing Tb, which can be detected through PMW remote sensing. The research employs the newly available Calibrated, Enhanced-Resolution Brightness Temperature (CETB) dataset to estimate the timing of snowmelt at higher spatial resolution (~3-6 km). Melt detection algorithms will be refined using the diurnal amplitude variation (DAV) approach established by Ramage *et al*. We will determine and automate the range and optimum Tb and DAV thresholds (legacy thresholds of 246K / ±10K for Special Sensor Microwave Imager or SSM/I) in Alaska watersheds using existing and supplemental observational and reanalysis datasets as well as different mathematical analysis, such as histogram and time series analysis, and derivatives. We expect improved melt timing and a range of thresholds sensitive to different terrain and environments. We will compare algorithm results with ground-based measurements compiled from multiple sources, such as air and snow temperatures, snow water equivalent (SWE), snow depth, and stream discharge. This study offers an understanding of how the use of higher-resolution CETB data and automatic approaches can enhance snowmelt analysis, granting hydrologists the ability to examine timing and patterns of snowmelt across different regions and snow types.

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