Testing Calibrated Enhanced Resolution Brightness Temperature (CETB) to Detect Significant Events in Lake Ice Formation and Evolution on Large Northern Lakes

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ABSTRACT

Calibrated, Enhanced-Resolution Brightness Temperatures (CETB) Earth System Data Records (ESDR) records of Advanced Microwave Spectroradiometer for EOS (AMSR-E) data provide an opportunity to evaluate freeze–thaw dynamics on northern lake systems. CETB data were created using the radiometer version of the Scatterometer Image Reconstruction (rSIR) technique. These enhanced-resolution data are 64 times finer spatial resolution at 36 GHz frequencies (3.125 km pixels) than the historical 25-km data products. They provide significant improvement in the ability to distinguish finer spatial patterns, including lake margins and spatiotemporal variations across large lakes. CETB products include previously unavailable statistical variables, which capture information about the state of dynamic surfaces, such as formation and development of lake ice, snow melt, and transition to open water. Separation between the minimum and maximum rSIR daily brightness temperature is significant in heterogeneous landscapes undergoing changes. We calculate the spatial standard deviation (SD) of rSIR data and compare the spatial and temporal variation to other factors such as temperature, ice characteristics, and other sensors to determine if this is a robust indicator of environmental transitions. We investigate patterns of high-resolution spatial variation and test the ability to use the spatial standard deviation to identify significant events in lake ice formation and evolution. These ideas are explored for sample large northern lakes, such as Great Slave Lake in the Northwest Territories, Canada.

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