Monitoring Ice Phenology of Small Ponds and Lakes using Sentinel-1 and Cloud-Based Detection Algorithms

GRANT E. GUNN¹, ERIN BUNTING¹, AND DI YANG²

ABSTRACT

Lake ice phenology (freeze-up, break-up dates, total days ice-covered) has been tracked using active microwave scatterometers and SAR sensors with varying degrees of success, typically limited by spatial resolution and temporal resolution, respectively. With the launch of Sentinel-1 A/B, consistent SAR acquisitions data are freely available, increasing the accessibility and operational utility of the constellation of high-resolution C-band SAR observations to observe the evolution of ice cover over freshwater lakes and ponds in northern environments.

This study introduces the development and preliminary results of an automated approach to track ice phenology using C-band acquisitions for freshwater lakes on the North Slope of Alaska. The algorithm utilizes the catalogue of Sentinel-1 A/B acquisitions available to Google Earth Engine to produce an estimation of the dates thermodynamic regime shifts on a per-pixel basis, producing intra-lake ice phenology at a minimum spatial resolution of 40 x 40 meters. The development of automated cloud-based algorithms to track physical characteristics of landcover is a burgeoning area of research development. With the movement towards an increase in temporal observations with SmallSats, as well as the upcoming launch of the RADARSAT Constellation Mission slated to increase the data volume available to researchers, so do the computational requirements for algorithm development. This presentation presents an initial step to utilize cloud-based processing for the identification of physical parameters of the cryosphere.

¹ Michigan State University, East Lansing, MI, USA
² University of Florida, Gainesville, FL, USA