B05-P10

ARCTIC SEA ICE THICKNESS MONITORING USING CRYOSAT-2 SATELLITE DATA

Sanggyun Lee *(Ulsan National Institute of Science and Technology, Republic of Korea)*
Jungho Im *(Ulsan National Institute of Science and Technology, Republic of Korea)*
Hyangsun Han *(Ulsan National Institute of Science and Technology, Republic of Korea)*
Jinwoo Kim *(LIG, Republic of Korea)*

ersgis@unist.ac.kr

Arctic sea ice is one of the significant components of the global climate system as it plays a significant role in driving global ocean circulation, provides a continuous insulating layer at air-sea interface, and reflects a large portion of the incoming solar radiation in Polar Regions. Sea ice extent has constantly declined since 1980s. Its area was the lowest ever recorded on 16 September 2012 since the satellite record began in 1979. Arctic sea ice thickness has also been diminishing along with the decreasing sea ice extent. Because extent and thickness, two main characteristics of sea ice, are important indicators of the polar response to on-going climate change, there has been a great effort to quantify them using various approaches. Sea ice thickness has been measured with numerous field techniques such as surface drilling and deploying buoys. These techniques provide sparse and discontinuous data in spatiotemporal domain. Spaceborne radar and laser altimeters can overcome these limitations and have been used to estimate sea ice thickness.

In this study, Arctic sea ice freeboard and thickness were estimated using CryoSat-2 SAR and SARIn mode data that have sea ice surface height relative to the reference ellipsoid WGS84. In order to estimate sea ice thickness, freeboard, elevation difference between the top of sea ice surface should be calculated. Freeboard can be estimated with lead detection technique. A machine learning based lead detection method was proposed. CryoSat-2 profiles such as pulse peakiness, backscatter sigma-0, stack standard deviation, skewness and kurtosis were examined to distinguish leads from sea ice. Near-real time cloud-free MODIS images as CryoSat-2 data were used to extract lead reference data. Two rule-based machine learning approaches--See5.0 and random forest--were evaluated for lead analysis. Using the freeboard height calculated from the lead analysis, sea ice thickness was finally estimated using the Archimedes' buoyancy principle with density of sea ice, sea water and snow and the height of freeboard (Figure 1). Freeboard and thickness were validated with ESA airborne Ku-band interferometric radar and Airborne Electromagnetic (AEM).

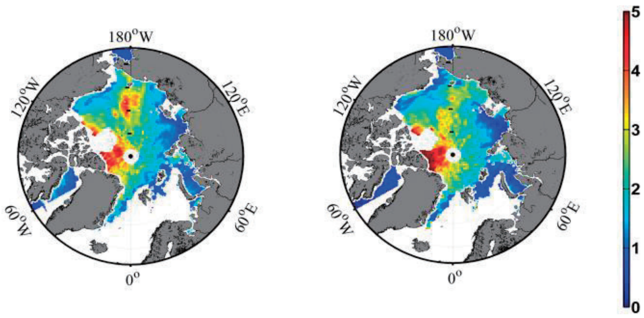

Figure 1. Arctic sea ice thickness from CryoSat2- in March and April 2014