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MELT POND DELINEATION FROM ARCTIC SEA ICE USING VHR SATELLITE IMAGE

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Arctic sea ice reflects climate changes and gives feedback continuously from the global changes with variations of retreat and advance in time and space domain. Distribution of melt pond on the sea ice has been recognized as one of the factors showing the climate change effects, and the pond induces or accelerates further rapid changes of arctic sea ice. Information of sea ice regarding extents and concentrations has been extracted from passive microwave remote sensing datasets, e.g., SSM/I and SSMIS, and has been widely used to global climate change studies.

In order to conduct detailed melt pond delineation and classification, VHR (very high resolution) optical satellite image was obtained in Aug. 2014 during arctic sea expedition using Araon icebreaker. The VHR image was from KOMPSAT-3 (Korea Multi-purpose Satellite-3) with a panchromatic band of 0.7 m spatial resolution and a multispectral imagery containing blue, green, red and near infrared wavelength bands of 2.8 m spatial resolution, respectively. Field investigations were also conducted on the sea ice during the expedition, and physical and spectral characteristics of the melt pond and surrounding sea ice were collected. The physical structure of melt pond and sea ice was outlined from the field investigations in a view of spectral reflectance characteristics of each melt pond and sea ice constituent part. The VHR images were carefully co-registered between high spatial resolution pan band and multispectral bands to minimize spatial discrepancy before spatial enhancement using spectral sharpening methods, and then the melt ponds were delineated using spectral index and thresholding methods based on spectral contrast between sea ice constituents such as water, snow and ice.

The results from this study imply applicabilities of VHR satellite images for validation of coarse resolution passive microwave satellite data compared to previous shipborne or airborne high resolution image datasets, and the delineation of melt pond from high-resolution datasets may suggest more detailed information regarding phase of melt pond from beginning of pond to sea ice bottom penetration.