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Investigating Monostatic TS-X DRA acquisitions and Near-coincident C and L - band Fully Polarimetric SAR for Arctic Sea Ice Characterization

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Satellite borne Synthetic Aperture Radar has proven to be a valuable tool for sea ice monitoring for more than two decades. Satellite borne SAR is capable of covering almost any region on earth with short recurrence periods (at least daily), even during rough weather conditions. This last point is particularly helpful in the surveillance of sea ice, which is mostly encountered in remote latitudes. In this work, we investigate the different response and sensitivities of X, C and L band fully polarimetric, temporally and spatially near coincident SAR acquisitions for sea ice characterization. The X-band fully polarimetric data was acquired in monostatic StripMAP Quad polarimetric (Dual Receive Antenna) mode, C- band fully polarimetric data was acquired in RADARSAT-2 Fine Quad (FQ) mode and L-band fully polarimetric data was acquired in ALOS-2 PALSAR-2 Stripmap Quad polarimetric (HBQ) mode. Co-located SAR images are compared with helicopter-borne ice thickness measurements acquired during the N-ICE2015 drift study in the region north of Svalbard in April 2015 coordinated by Norwegian Polar Institute. In addition to detailed analysis of different polarimetric features, we also characterize sea ice using two different algorithms. The first algorithm is based on Artificial Neural Network (ANN), where we extract 18 polarimetric features, followed by training and validation of an ANN to classify each pixel into an ice type. Some polarimetric features such as polarimetric Span, Geometric Intensity are proven to be more useful than eigen value decomposition based features. The second algorithm is an image segmentation technique based on “Extended Polarimetric Feature Space" (EPFS) which exploit polarimetric as well as textural information, followed by a class assignment process with the help of ancillary information. The classification/segmentation approaches are based on and validated by in-situ data acquired during the N-ICE2015 field campaign.