Abstract

82A3205

Arctic sea-ice classification and validation using a multi-frequency fully polarimetric and interferometric airborne F-SAR system

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Along with increasing scientific interest in sea ice, the operational aspect of high-resolution ice charting is becoming more important due to growing navigational possibilities in an increasingly ice-free Arctic, especially through the marginal ice zone. Despite proven sea-ice classification achievements on single polarimetric SAR data, a fully automated, general-purpose classifier for single-polarimetric data has not been established due to large variation and incidence-angle dependencies of SAR backscatter. Recently, through the advent of polarimetric SAR sensors, polarimetric features have moved into the focus of ice-classification research. The higher information content of four polarimetric channels promises to offer a greater insight into the sea-ice scattering mechanism. While airborne and shipborne radar cannot always be used during adverse weather conditions, it provides us with unique simultaneous multi-frequency and fully polarimetric and interferometric observations, which is not possible at the moment using space-borne sensors. In this study, fully polarimetric data in L-, S- and X-band simultaneously acquired by DLR's FSAR system are investigated. The specific dataset was acquired in the framework of DLR-DALO ARCTIC'15 campaign over west Greenland. The proposed supervised classification algorithm consists of two steps: The first step comprises a feature extraction, the results of which are ingested into a neural network classifier in the second step for training and validation. The usefulness of different polarimetric features at different frequency bands is investigated using mutual information analysis along with quantitative comparison of classification results at different frequency bands. In this study we also investigated for the first time single-pass Across Track Interferometry (XTI)–derived sea-ice-freeboard measurement validation of our classification results with XTI-derived freeboard measurements.