Sea Ice Concentration Retrieval Based on Dual-Polarized C-Band SAR

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Ice concentration is defined as the proportion of the ice covered area over a given area. High-resolution ice concentration information are required for navigation, validating ice models and data assimilation. The currently available operational ice concentration products are based on microwave radiometer data and their typical resolution is several kilometers. For example University of Bremen delivers operational (global) ice concentration products based on AMSR-E and SSMI/S data using an algorithm called the ASI algorithm [1]. However, also data from SAR instruments cover large sea and ocean areas with a much higher precision than that of the radiometer data, and they are not very efficiently utilized in operational monitoring of the ice concentration yet. In [2] we have shown that the local autocorrelation can be used to distinguish between open water and sea ice for HH-polarized C-band data. Recently we have also studied the estimation of the ice concentration based on the C-band SAR HH-channel autocorrelation distributions [3]. In this presentation we also include the cross-polarized (HV) channel, and study whether the concentration estimates can significantly be improved by including the cross-polarized channel. In this experiment we use the HH-channel concentration estimate of [3] as a starting point. Then we additionally include two features based on the HV-channel: the HV channel backscattering coefficient σ^0_{HV}, and the polarization ratio $P = (\sigma^0_{HH} - \sigma^0_{HV})/(\sigma^0_{HH} + \sigma^0_{HV})$. The HH-channel estimate and the two new features with the incidence angle value are used as inputs of a multi-layer perceptron (MLP) neural network with the error backpropagation training algorithm. The incidence angle is used as one input to avoid the explicit modelling of the incidence angle dependence of σ^0_{HV}. The new concentration estimates are computed for the same data set as used in [3], and the performances of the single-polarization and dual-polarization algorithms can thus directly be compared. The data set consists of 31 dual-polarized wide swath mode Radarsat-2 images over the Baltic Sea, acquired during the first half of March 2011. The data set includes both dry snow cover and wet snow cover cases. The reference data used in training and testing of the algorithm are the ice concentrations of the gridded Finnish Ice Service ice charts. We also make a comparison with the ASI algorithm concentrations over the Baltic Sea area.

References

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