SEA ICE MONITORING IN THE BALTIC SEA USING DUAL-POL C AND L BAND SAR DATA

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1. INTRODUCTION

Monitoring of ice dynamics and ice type classification is an important task for understanding environmental changes as well as for safe winter navigation. SAR (Synthetic Aperture Radar) is a powerful spacebourne instrument to detect ridged ice regions as the radar backscatter is strongly influenced by geometrical properties of the ice surface. Data from polarimetric (dual) SAR sensors like Radarsat-2 and ALOS/Palsar enables to determine more precisely ice types as it contains more information about the ice surface geometry than single polarization images. Use of dual polarization SAR imagery also known as compact polarimetry has shown to be useful as it has reduced the complexity, cost and data rate of SAR image while preserving most of the capabilities of fully polarimetric image [1, 2, 3].

2. AIM

A study for sea ice monitoring and characterization was carried out in the Baltic Sea from January to March 2009. The focus of current study was on enhanced monitoring of small scale changes/processes in the western Estonian archipelago sea. Secondary objective was to compare the backscatter characteristics at different frequencies (C-band and L-band) and polarizations (HH, HV, VV) using data from different sensors.

3. DATA AND METHODS

Considering the objectives of the study high resolution SAR data from the following sensors was included: RADARSAT-2 (fine mode, HH/HV), ALOS/Palsar (fine mode, HH), ERS (image mode, VV) and ASAR (wide swath, HH). Also optical remote sensing data from MODIS (Moderate Resolution Imaging Spectroradiometer) sensor was used to carry out independent ice type classification. In addition to remote sensing imagery the meteorological data (wind measurements, air temperature, precipitation etc) from three different stations near the study area was analyzed to determine the cause of backscatter variations.

A sea ice classification from dual-pol Radarsat-2 imagery was performed. The classification on SAR image was based on entropy/alpha differences that were caused by ice type variations. Analysis showed that four ice types (level ice, fast ice, ridged ice, deformed ice and water) were identifiable from dual-pol data. Also two independent analyses that were performed on optical remote sensing imagery (MODIS) supported the classification results from Radarsat-2 data. The spectral classification from MODIS data enabled to separate ridged ice regions and fast ice areas [4].

4. RESULTS AND CONCLUSIONS

The backscatter properties of ice types detected from RADARSAT-2 (C-band, HH/HV) were compared with single-pol data from Palsar L-band (HH), ERS (VV), and ASAR (HH). Results showed that while C-band data was better for monitoring small scale ice deformations, the inclusion of L-band data improved significantly the analysis in snow covered ice regions in the coastal zone. The study provides additional information for enhanced ice monitoring in small areas (e.g. harbours, coastal zone) using high resolution data at multiple bands and polarizations.

5. REFERENCES

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