ANALYSIS OF THE SENTINEL-1 RADAR CONFIGURATION FOR SEA ICE MAPPING APPLICATIONS

Wolfgang Dierking
Alfred Wegener Institute for Polar and Marine Research

During the ICESAR campaign, which took place in March 2007, radar and optical imagery were acquired together with complementary data over ice-covered ocean areas in the region of Svalbard, using two airplanes as instrument platforms. The objective was to provide high-resolution low-noise radar imagery as a basis for investigations on the technical performance of ESA's Sentinel-1 mission for sea ice mapping.
The radar data were acquired at C- and L-band at different polarizations. Sea ice classification was carried out visually utilizing the high-resolution low-noise radar images, taking into account optical scanner data, hand-held photography, field notes, and meteorological data. The SAR images were then used to simulate coarse-resolution products with higher noise levels similar to the interferometric wide swath mode (IWSM) of the planned Sentinel-1 mission. Where possible, they were also compared to Envisat ASAR imagery.

The results of the investigations show that the NESZ of the Sentinel-1 SAR (-22dB) is acceptable at like-polarization, although it is difficult to distinguish different stages of new ice. At cross-polarization, the noise level may be critical for automated sea ice classification. The spatial resolution provided by the IWSM is sufficient for a robust separation of sea ice types under different ice conditions. Significant differences between images of different polarizations occur only in special cases but the VV-polarized channel is preferable because of a higher signal-to-noise ratio. For the incidence angle range from 30 to 55 deg, the ICESAR data do not indicate any significant angle sensitivities of intensity contrasts between ice types.

It was also found that a combination of C-band and L-band SAR images improves the accuracy of sea ice classification in particular with regard to the separation of deformed and level ice and of thin ice classes.

In this presentation, results will be summarized and examples of the acquired imagery will be shown for demonstration.