

# High Resolution Sea Ice Motion Estimation from C- and X-Band SAR Data Acquired During Antarctic Circumnavigation Expedition

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## ABSTRACT

A better understanding of the Cryosphere is essential, not only for its preservation, but for the whole planet. The poles are strongly affected by climate change. Conversely, the Polar Regions influence the climate from the poles to the equator through feedback mechanisms between ice, ocean, and atmosphere.

In order to gain in-depth interdisciplinary knowledge, the Antarctic Circumnavigation Expedition is carrying out experiments from October 2016 to March 2017 (planned). It brings together scientific teams from different countries on board the Russian research vessel Akademik Treshnikov. For navigation assistance in ice infested waters, the German Aerospace Center (DLR) supported the campaign with acquisitions of space-born Synthetic Aperture Radar (SAR) images and L2 products such as operational sea ice classification delivered to the ship in near-real time (NRT).

Navigation in Antarctic Waters is extremely difficult. Drifted by wind and currents, the sea ice situation can change significantly within hours. When ice is driven together, pressure ridges and areas of thick pack ice can emerge, which are major obstacles even for icebreakers. For a detailed look into the current ice situation, we present the prototype of a new software processor that is aimed to derive high resolution sea ice motion fields on the basis of pairs of SAR images acquired by TerraSAR-X and RADARSAT-2, i.e. it is able to interlink X-Band and C-Band data. Due to the sun-synchronous orbit of both satellite missions, spatially and temporally near coincident acquisitions over Antarctica are possible multiple times per day, which allows frequent updates about the ice situation. For estimating the sea ice motion automatically from the acquired images, we make use of a phase correlation technique with a hierarchical motion estimation framework presented in [1]. The output motion field has a resolution of 500 m x 500 m and reveals small variations within the sea ice motion.

The implemented processor is intended to be part of the operational data processing chain at DLR Ground Station Network (GSN) sites.

Reference:

[1] Dimitri HAMIDI, Susanne LEHNER, Thomas KÖNIG, Andrey PLESKACHEVSKY. On the sea ice motion estimation with synthetic aperture radar. In Proc. TerraSAR-X Meeting Vortrags-Nr. CAL0166 (pp. 1-10). 2011.