



## **Age and thickness distribution of polynya sea ice in the Laptev Sea determined by satellite SAR imagery and airborne EM**

L. Rabenstein (1), T. Krumpfen (2), S. Hendricks (2), and J. Hoelemann (2)

(1) Institute of Geophysics, ETH Zurich, Switzerland (rabenstein@aug.ig.erdw.ethz.ch), (2) Climate Science Division, Alfred Wegener Institute, Bremerhaven, Germany

The importance and annual amount of sea ice volume produced during polynya opening events in the Siberian Laptev Sea is still controversially discussed. So far, published information about sea ice volume production are purely based on indirect thickness measurements of thin ice using remote sensing techniques or on computer simulations of sea ice growth based on reanalysis climate data. We recorded a sea ice thickness transect of approximately 160 km length using helicopter electromagnetics (HEM) in the region of the so called West New Siberian (WNS) Polynya located directly north of the Lena delta in April 2008. In addition, a time series of synthetic aperture radar (SAR) images covering the complete polynya region was analyzed and ice area fragments were tracked from their origin to the moment when we recorded their thickness. Both data sets together, HEM and SAR, provide the opportunity to classify overflowed ice areas in terms of age, area and thickness and therefore in terms of volume.

From December 2007 to April 2008 approximately 50.000 km<sup>2</sup> of sea-ice area was produced in the WNS polynya, which is more than the size of Switzerland. The youngest surveyed sea-ice was 6 days old and had a mean total and a mean level-ice thickness of 0.2 m. The oldest surveyed ice floe had an age of 104 days and a mean total thickness of 2.4 +/- 0.3 m and a mean level ice thickness of 1.8 +/- 0.3 m. The error is based on the HEM instrument accuracy and a lag of snow thickness data. Assuming that ice thickness along the HEM transect was representative for entire overflowed ice areas, our calculations result that the produced sea ice area contained a volume of approximately 86 km<sup>3</sup>. This is about 1.8 % of the Arctic wide ice production between October 2007 and March 2008, as it was published by Kwok et al. 2009 on the basis of ICE-Sat ice thickness data.

The combined HEM and SAR study enabled us furthermore to analyze thickness vs. age relations of first year ice floes. Mean thickness showed to be a bad indicator for ice age determination and vice versa, due to the dynamic component of sea-ice growth. The most surprising result was a 16 days old ice floe which was piled up to deformed sea ice with a mean thickness of 2.4 m. Mean level-ice thickness is a far better indicator for ice age, although we found mean thickness variations for level ice of the same age of about 0.5 m.

Reference: Kwok, R., Cunningham, G.F., Wensnahan, M., Rigor, I., Zwally, H.J., Yi, D., Thinning and volume loss of the Arctic Ocean sea ice cover: 2003-2008, *Journal of Geophysical Research*, 114, 2009