Studies on sea ice and polynya off the Cape Darnley Antarctica, using the ALOS PALSAR and other satellite data

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The Cape Darnley polynya, which is located west of the Amery Ice Shelf in East Antarctica, is a huge coastal polynya whose size is more than 100 km x 100 km. According to our preliminary analysis from passive microwave (SSM/I) data, this polynya is suggested to be the second largest ice production area, where the formation of Antarctic Bottom Water is discovered by the recent observation. Thus this polynya is a very good site of thin ice region for validation of satellite data and also for investigation of the polynya formation. The purpose of this study is to develop and validate the sea ice thickness algorithm from the combination of the ALOS PALSAR data and other satellite data, and to clarify the formation process of the polynya and its variability.

In the area of new (thin) sea ice, we examine the relationship among ALOS PALSAR data, passive microwave data, and sea ice thickness derived from the MODIS data and heat flux calculation. The VV-to-HH backscattering ratio from PALSAR polarimetric mode is found to be well correlated with sea ice thickness probably because of high correlation of the surface salinity and ice thickness. The PALSAR backscatter images can discriminate between icebergs, fast ice, first-year ice, and new ice around this area. Time series of SAR images including ALOS PALSAR and ENVISAT ASAR has revealed the time evolution and seasonal variation of this polynya and the surrounding regions, suggesting that the blocking effect of sea ice by the grounded iceberg tongue upstream of the polynya is considered to be very important on the polynya formation.

In February 2010, we plan to deploy two sets of IPS (Ice Profiling Sonar)/ADCP/CT moorings for continuous monitoring of ice and ocean inside the polynya area. This will provide ice thickness data with high accuracy and high temporal resolution. These data will serve as the great data set for truth and validation of ice thickness algorithm of PALSAR and other satellite data.