Polarimetric characteristics of ice on Lake Saroma observed by Pi-SAR-L2
(A study on environmental measurement by synthetic aperture radar)

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ABSTRACT

The main objective of this research is to investigate the possible use of L-band polarimetric SAR data to monitor sea ice in relatively thin sea ice area. By taking profiles of polarimetric parameters along the line crossing from the west edge to the eastern area of Lake Saroma, the polarimetric and the incidence angle characteristics for various ice types and open water were extracted. It was found that VV to HH backscattering ratio at higher incidence angle was correlated with ice thickness and sensitive to thickness difference. The scattering entropy of OW was lower than any other ice types even at the higher incidence angles.

RESEARCH OBJECTIVES

- ☑ Investigate the possible use of SAR data to monitor sea ice in the southern region of the Sea of Okhotsk.
- ☑ Results will be applied to ALOS-2/PALSAR-2 data.

OBSERVATION EXPERIMENT IN 2016

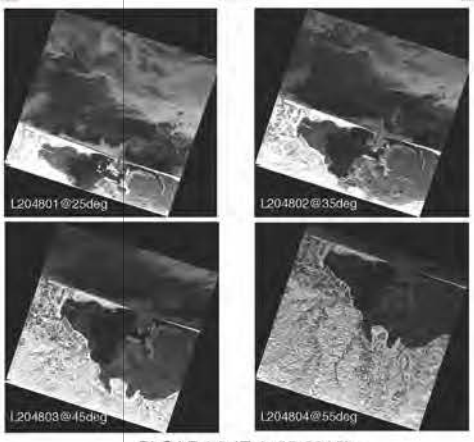
- ☑ Airborne L-band SAR (Pi-SAR-L2) acquired data at four different incidence angle were acquired.
- ☑ Various ice types were available in the west part of the lake

TEST SITE: LAKE SAROMA

The Sea of Okhotsk is located in the most southerly region of the northern hemisphere, where sea ice exists only during wintertime. Since the extent of sea ice in this area is related to local as well as global climate change, an application for monitoring sea ice by using remote sensing data in this region has been studied. Our test site, Lake Saroma, is located the southern edge of this area.

Pi-SAR-L2 observation

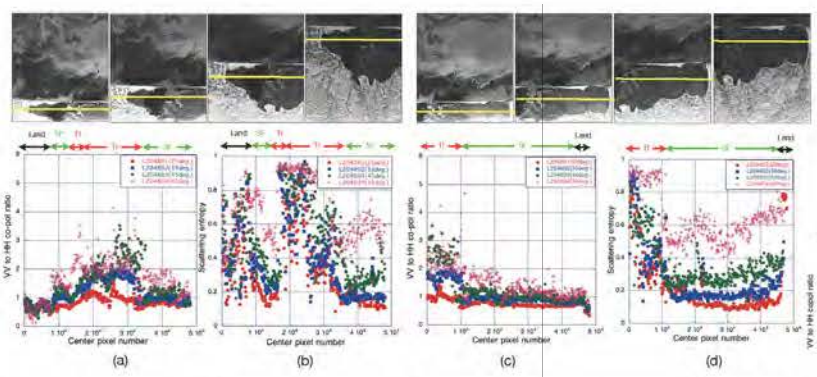
Bandwidth	85 MHz
Sampling frequency	100 MHz
Observation height	5 -12 km
Image width	<= 20 KM
AD/DO	8 bits I + Q
Range resolution	1.76 m
Azimuth resolution	3.2 m(4 looks)
NE sigma zero	-35 dB
Incidence angle	10-63 deg.
Polarimetry	Quad-pol.
Pulse length	10-30 micro-sec.
Tx power	3.5 KW



Pi-SAR-L2 (Feb.25,2016)

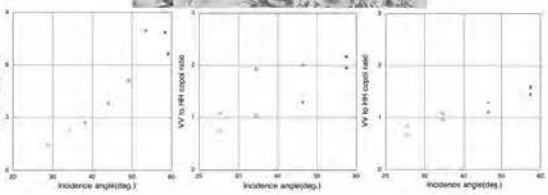
Pi-SAR-L2 data analysis

1. Data acquired were Level 1.1.
2. Location and incidence angle were calculated by using facter.m information provided by JAXA.
3. Calculate polarimetric characteristics along the line crossing the lake.



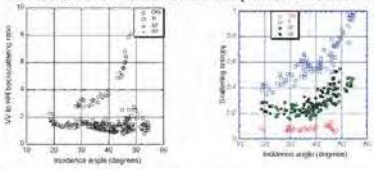
Profiles of polarimetric parameters along the horizontal line in west part. (a) VV to HH backscattering ratio (b)scattering entropy.

Profiles of polarimetric parameters along the horizontal line in east part. (c) VV to HH backscattering ratio (d)scattering entropy.



Total power **VV/HH co-pol ratio** **Scattering entropy**

Most results are consistent with our previous work shown below



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SUMMARY

- ☑ Pi-SAR-L2 acquired the data covering the southern region of Sea of Okhotsk including Lake Saroma on February 25, 2016.
- ☑ By taking profiles of polarimetric parameters extracted from Pi-SAR-L2 data along the line crossing from west to east coast of the lake, the followings were found.
  - ✓The co-pol. ratio at higher incidence angle was correlated with sea ice thickness. The co-pol ratio was very sensitive to the thickness difference for thin ice at incidence angle of 35 and 45 degree.
  - ✓The scattering entropy of OW was lower than any other ice types even at the higher incidence angles. However, calm open water may take relatively high scattering entropy due to its low backscattering coefficient close to noise equivalent backscattering coefficient.

FUTURE WORK

- ☑ Comparison between SAR and in-situ data is necessary to evaluate our results quantitatively.
- ☑ Solve an uncertainty for scattering entropy to detect open water.

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