SARデータを用いた海氷物理量推定の高精度化に関する研究

SARデータを用いた海氷物理量推定の高精度化に関する研究

(ALOS/PALSARによる海氷観測の可能性)

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Outline

- ALOS/PALSAR data characteristics
- Summary of previous study
  - ERS-1/2 and JERS-1 data
  - Airborne SAR data
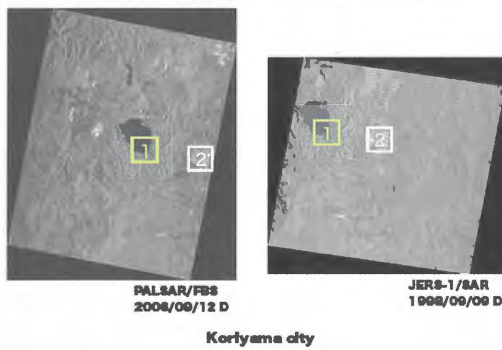- Possible use of PALSAR data in sea ice research

PALSAR specification

	PALSAR	JERS-1/SAR
Center frequency	1.27GHz	1.275GHz
Transmission peak power	2.0kw	1.3kW
Chirp bandwidth	28MHz/14 MHz	15MHz
Antenna size (Az x El)	8.9m x 3.1m	11.9m x 2.2m
Polarization	HH/HV/VH/VV	HH
Incidence angle	8~60 deg.	34~40 deg.
Observation width	70km	75km
Spatial resolution	10m	18m
Bit length	5bits (I and Q)	3bits(I and Q)
Noise equivalent sigma0	-25dB	-20.5dB

PALSAR distinct feature

- High spatial resolution
- Low noise equivalent backscattering coefficient
- Large dynamic range
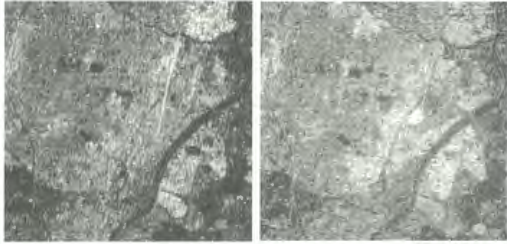- Various incidence angle
- Polarimetry

Comparison between PALSAR and JERS-1/SAR

PALSAR/FBS 2006/09/12 D — JERS-1/SAR 1998/09/09 D

Koriyama city

Area 1 (6.4km x 6.4km)

PALSAR/FBS 2006/09/12 — JERS-1/SAR 1998/09/09
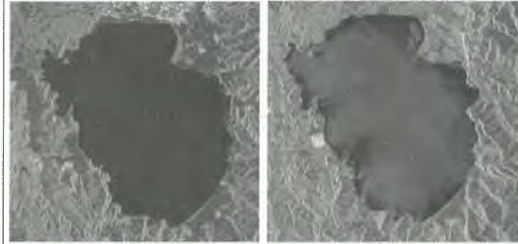
Konan town

Area 2 (6.4km x 6.4km)

PALSAR/FBS
2006/09/12 D

JERS-1/SAR
1998/09/09 D

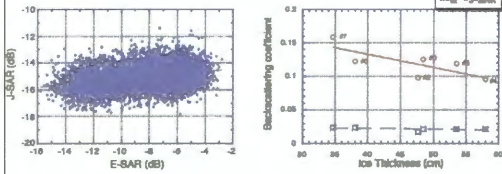Downtown Koriyama

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Variable incidence angle

PALSAR/FBS
2006/09/12 D
Incidence=28 deg.

PALSAR/FBS
2006/09/30 A
Incidence=24 deg.

Lake Inawashiro

Possibility in sea ice monitoring

- NEσ^0 improvement ➡ •Backscatter decrease with sea ice growing
  - •Improvement ice classification accuracy

H. Watabayashi and F. Nishio. A study of ice on lake Barena using SAR data. 日本リモートセンシング学会誌, Vol. 18, No. 2, pp. 88(148)-95(155) (1998)

Full polarimetry
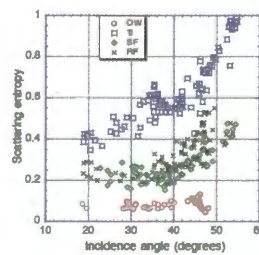

PALSAR image@Dualier
R:HH-VV
G:HV
B:HH+VV

PALSAR/PSR
2007/01/28 D

Sea of Okhotsk
(Center N44.69, E144.42)
96.8km x 12.1km

Utilization of PALSAR polarimetric data

☑ **Scattering entropy**
   Open water detection
   Thin ice detection

☑ **Double bounce**
   Thin ice detection

☑ **RR-LL coherence, Scattering anisotropy**
   Roughness inversion
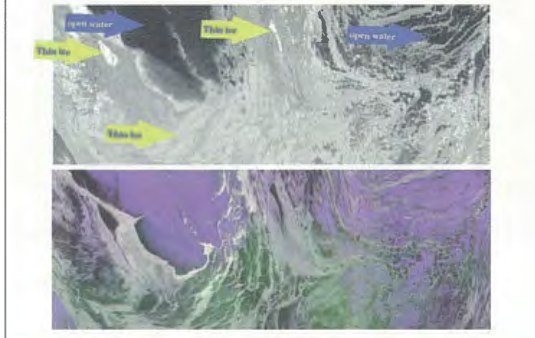

Scattering Entropy

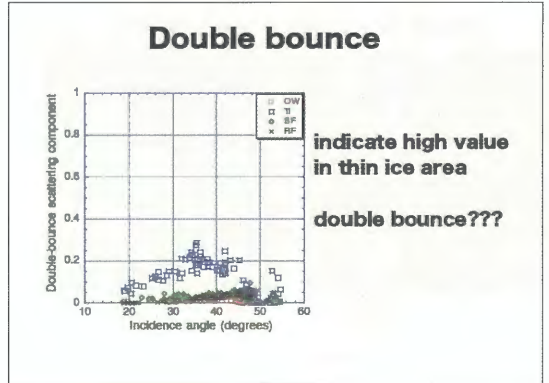
$$H = \sum_{i=1}^{3} -P_i \log_3 P_i$$

Open water detection
in wide incidence angle

H. Watabayashi, T. Matsuoka, K. Nakamura and F. Nishio : Polarimetric characteristics of sea ice in the Sea of Okhotsk observed by airborne L-band SAR, IEEE Trans. on Geo-science and Remote Sensing . Vol. 42, No.11, 2412-2425 (2004.11)
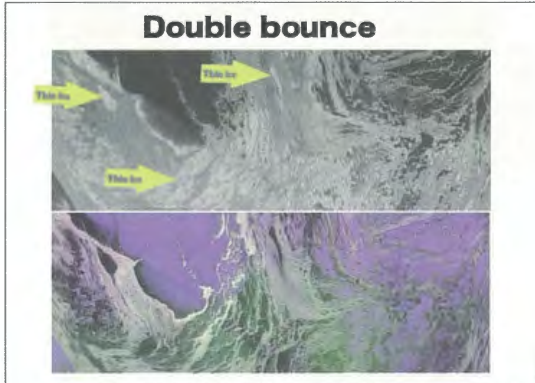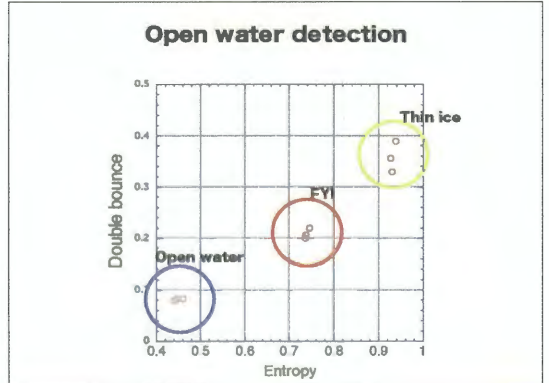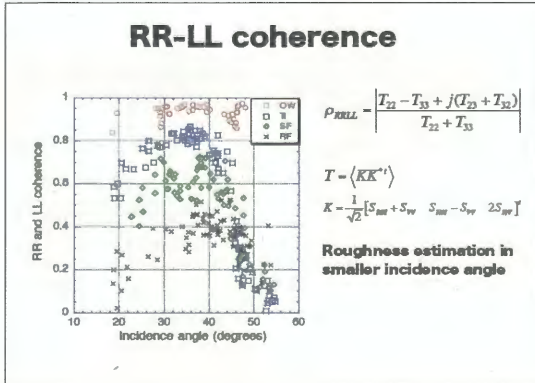
Scattering Entropy

Double bounce

indicate high value in thin ice area

double bounce???

Double bounce

Open water detection

Thin ice

FYI

Open water

RR-LL coherence

$$\rho_{RRLL} = \left| \frac{T_{22} - T_{33} + j(T_{23} + T_{32})}{T_{22} + T_{33}} \right|$$

$$T = \langle \overline{KK}^{*t} \rangle$$

$$K = \frac{1}{\sqrt{2}}[S_{HH} + S_{VV} \quad S_{HH} - S_{VV} \quad 2S_{HV}]$$
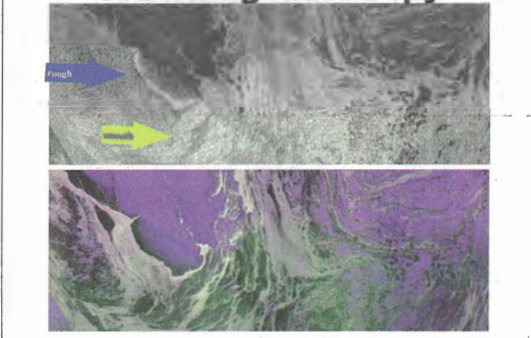
Roughness estimation in smaller incidence angle
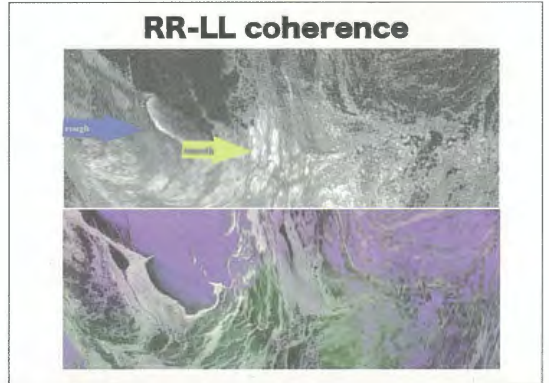
RR-LL coherence

Scattering Anisotropy

**Sea Ice thickness retrieval by PALSAR
(Summary)**

- ☑ Open water detection by entropy
- ☑ Thin Ice detection by double bounce
- ☑ Surface roughess estimation for general FYI
  - RR and LL coherence or
  - Scattering anisotropy
- ☑ Ice surface dielectric constant estimation
  - Ice thickness related parameter