Iceberg Research, Development & Services

C-CORE

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C-CORE

Innovative engineering services focused on:
- technology adaptation and integration
- engineering modeling, testing and analysis
- design recommendation

Ice Engineering

Geotechnical Engineering

Radar & Vision
C-CORE’s iceberg related work has included:

- Iceberg Validation
- Iceberg/Ship Discrimination
- Icebergs in Sea Ice
- Development of Operational Services
R&D History

**Validation Activities:**
- 1997-2002 RADARSAT-1
- 2002-2003 ENVISAT ASAR
- 2005-2006 RADARSAT-2 Simulated modes

**Ship/Iceberg Discrimination:**
- 2000-2003 RADARSAT-1
- 2003 ENVISAT ASAR Single Channel
- 2004-2006 ENVISAT ASAR Dual Channel
- 2005-2006 RADARSAT-2 Simulated model

**Icebergs in Sea-ice:**
- 2003 RADARSAT-1
- 2008-2009 RADARSAT-1, RADARSAT-2, ENVISAT ASAR
Validation – Performance Curves

Performance curves developed iceberg detection for 30m resolution SAR
Premise of Ship/Iceberg Discrimination

- Complicated shape
- Low pixel variation
- Low relative backscatter

- Smooth or elongated shape
- Sidelobes in range/azimuth
- High pixel variation and relative
- High relative backscatter backscatter
### Summary

<table>
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<tr>
<th>Mode</th>
<th>Discrimination Capability</th>
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<tr>
<td>SCNB</td>
<td>Poor</td>
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<tr>
<td>Wide</td>
<td>Fair/Good</td>
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<tr>
<td>Fine</td>
<td>Excellent</td>
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- Discrimination ability degrades with resolution
- Mean/variance works only at Fine mode
- Less target pixels = less information
- Require extra blob descriptors
ENVISAT ASAR Ship/Iceberg Discrimination

- Icebergs and Ships have different characteristics in each channel
- ENVISAT HV channel is limited due to the noise floor
- Very high discrimination rate on larger targets
- Lower discrimination rate achieved for targets on the order of the resolution of the SAR data
Quad Pol Ship/Iceberg Discrimination

Analysis with simulated RADARSAT-2 modes:
- Quad-pol outperforms for very high resolution data
- Quad and Dual-pol perform similarly for high resolution Fine mode
- Quad and Dual cross-pol perform well for lower resolution
Operational Services

European Space Agency (ESA)
Polar View

Services:
- Ship/Iceberg Monitoring – Grand Banks
- Icebergfinder.com
- Iceberg Population Survey
- Iceberg Monitoring – Coast of Labrador
- Iceberg Monitoring – Yacht Races
- Historical Iceberg Surveys

End-Users:
- Canadian Ice Service (CIS)
- International Ice Patrol (IIP)
- Tourism Industry
- Oryx Quest Yacht Race
- Volvo Ocean Yacht Race
- VELUX 5 Oceans Yacht Race
- Antarctica Cup Yacht Race
- Oil & Gas Companies

Canadian Space Agency (CSA)
Earth Observation Application Development Program (EOADP)
Iceberg Monitoring
Grand Banks/Labrador Coast
Iceberg Population Survey

Baffin Bay

Davis Strait
Iceberg Monitoring – Yacht Races

- Oryx Quest
- Volvo
- VELUX 5 Oceans
- Antarctica Cup
Iceberg and Sea Ice Monitoring