RADARSAT-2
Applications for Civil and Commercial Situational Awareness

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RADARSAT-2

Extends the Legacy of RADARSAT-1 (data compatibility)

Provides new capabilities to address situational awareness

- *Polarimetry*
- *Infant Constellation (2 Birds)*
- *Rapid Response*

RADARSAT-2 General Spacecraft Information

Type of satellite	Synthetic Aperture Radar (SAR)
Design lifetime	7 years
SAR antenna dimensions	15m x 1.5m

Radar Instrument Characteristics

Frequency	Band C-Band (5.405 GHz)
Bandwidth	100 MHz
Polarization	HH, HV, VH, VV

Orbit Characteristics

Orbit	Sun-synchronous
Altitude	798 km
Inclination	98.6 degrees
Period	100.7 minutes
Orbits per day	14
Repeat Cycle	24 days

Coverage Access (500km swath)

North of 70	Daily
North of 48	Every 1-2 days
Equator	Every 2-3 days

SAR Complements Visible & Near Infrared Observations

Advantages

Calibrated (Consistent measurements)
Monostatic (repetitive measurements)
Polarimetric (physical Character States)

Develop Applications based on empirical relationships

SAR Applications

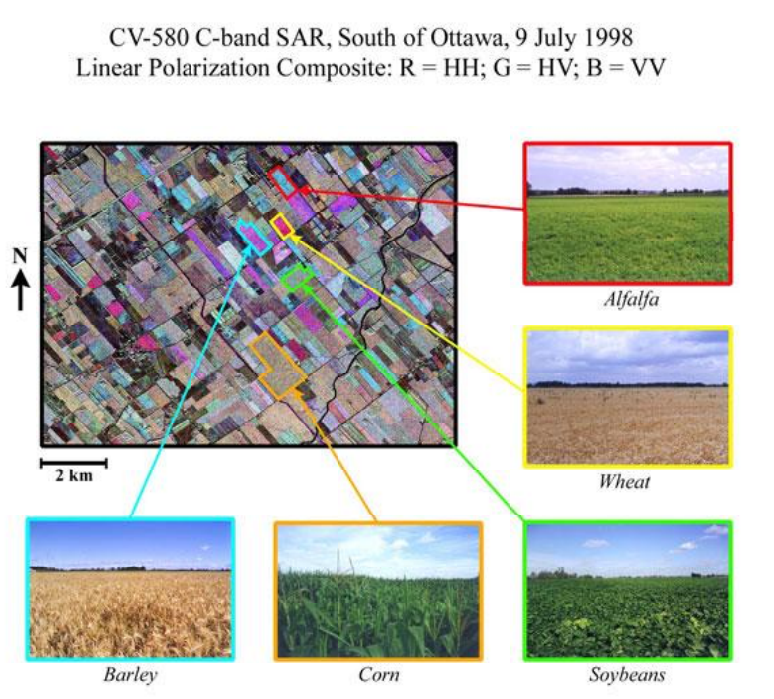
Agriculture

Compliance Monitoring:	•Geological Structure Mapping •Farming Activity •Land use
Crop Assessment:	•CropType Determination •Crop Damage Assessment
Land use Monitoring:	•Temporal Change Evaluation
Crop Monitoring:	•Crop Monitoring
Soil Condition Monitoring:	•Tillage Practices •Soil Moisture Assessment

SAR Applications

Agriculture

Crop Identification and Monitoring



Source: McNairn, H., J. J.van der Sanden, R. J. brown, and J. Ellis. 2000. Potential of Radarsat-2 for Crop Mapping and assessing crop conditions 2nd International Conference on Geospatial Information in Agriculture and Forestry, Lake Buena Vista, Florida, 10-12 January 2000

SAR research has confirmed that microwaves are sensitive to both soils and crop characteristics. Results using SAR backscatter time series from RADARSAT-1 have shown differences in crop type and crop indicators like crop height, biomass and leaf area index.

Polarimetric measurements

- Crop identification
- Crop Yield
- Acreage Estimates

Users:

- Governments Agencies (Policy)
- Insurance
- Commodities Brokers

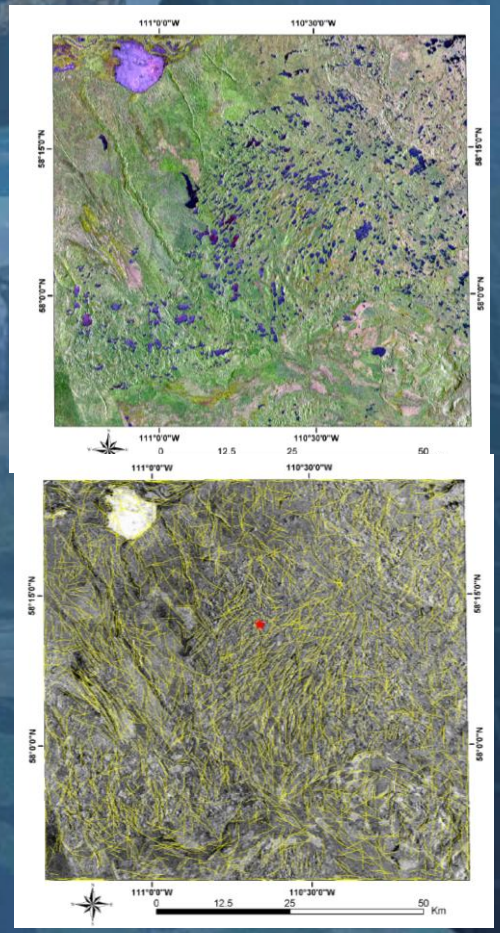
SAR Applications

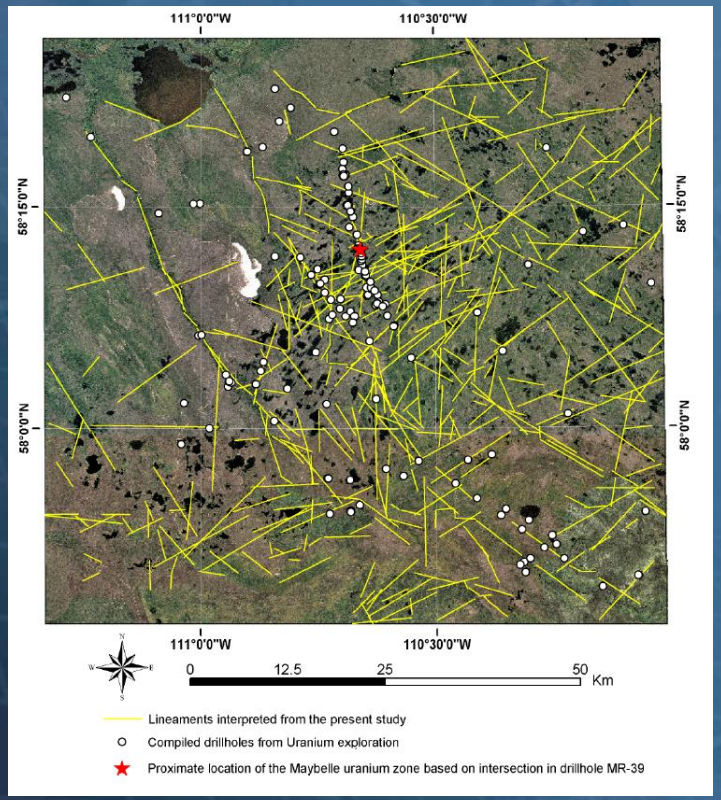
Geology

Geological Mapping:	•Geological Structure Mapping •Surficial Bedrock Geologcal Mapping •Lineamant Identification
Quaternary Mapping:	•Landform Delineation •Surficial Material Assessment
Hydrocarbon Exploration:	•Geological Structure Mapping •Sedimentology Mapping •Lineamant Identification
Geological Hazard Identification:	•Sesimec Zones Identification •Landslide Hazard Assessment •Coastal Erosion Assessment
Mineral Exploration:	•Lineamant Identification

SAR Applications

Mineral Exploration:
Lineament Identification



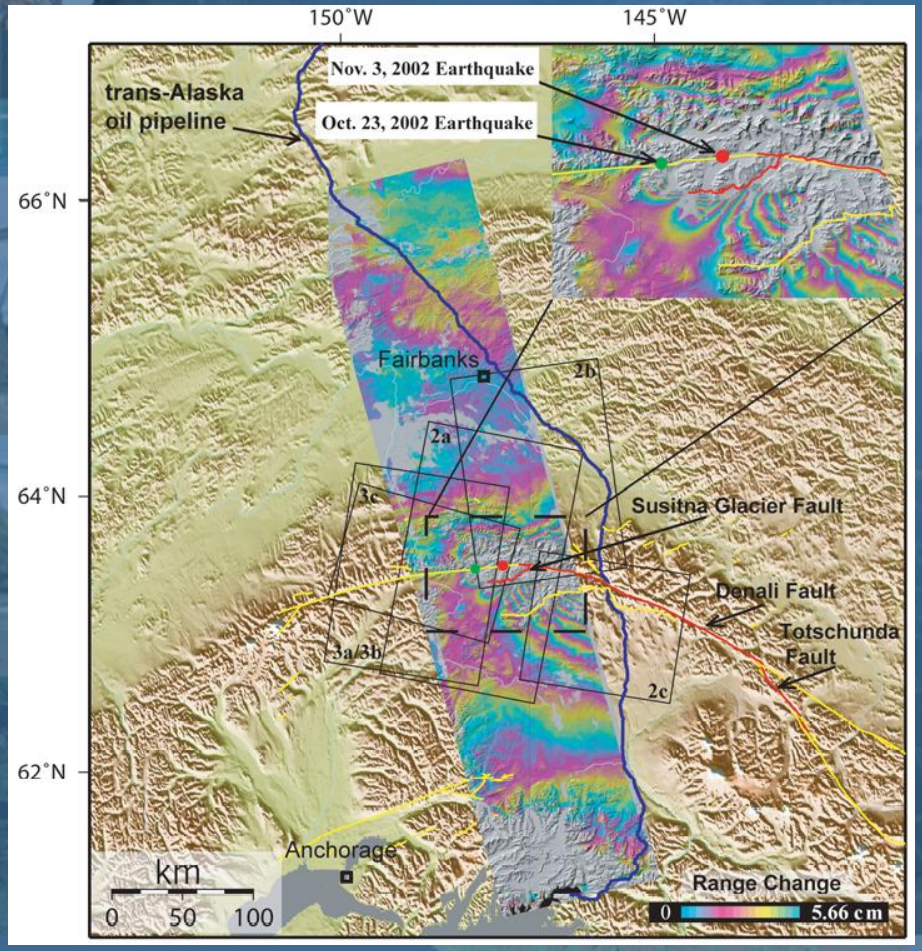


Multiple SAR collections at different incidence angles highlight geological structures

Imaging processing techniques are used to reveal organized patterns

Source: Mei S., D. Pana , M. Fenton and R. Oslo 2005. Preliminary Surficial Lineaments Mapping for the Maybelle River Area Northear Alberta, using Remote Sensing Data Energy & Utilities Board, Alberta Geological Survey EUB/AGS Earth Science Report 2004 - 02

SAR Applications



Geological Hazards

Seismic Zone Identification

Radarsat-1 interferogram showing the displacement over the western part of the 340-km long surface ruptures (red lines) associated with the M 7.9 Denali earthquake that occurred on 3 November 2002. The yellow lines represent faults that show evidence of activity during Quaternary time.

The earthquake ruptured about 340 km of the Denali Fault system with observed right-lateral offsets of up to 9 m

Source: LU, Z. T. Wright, and C Wicks 2003. Deformation of the 2002 Denaili Fault Earthquakes, Mapped by Radarsat-1 Interferometry. EOS, Transactions American Geophysical Union, *VOL. 84, NO. 41, doi:10.1029/2003EO410002*

SAR Applications

Forestry

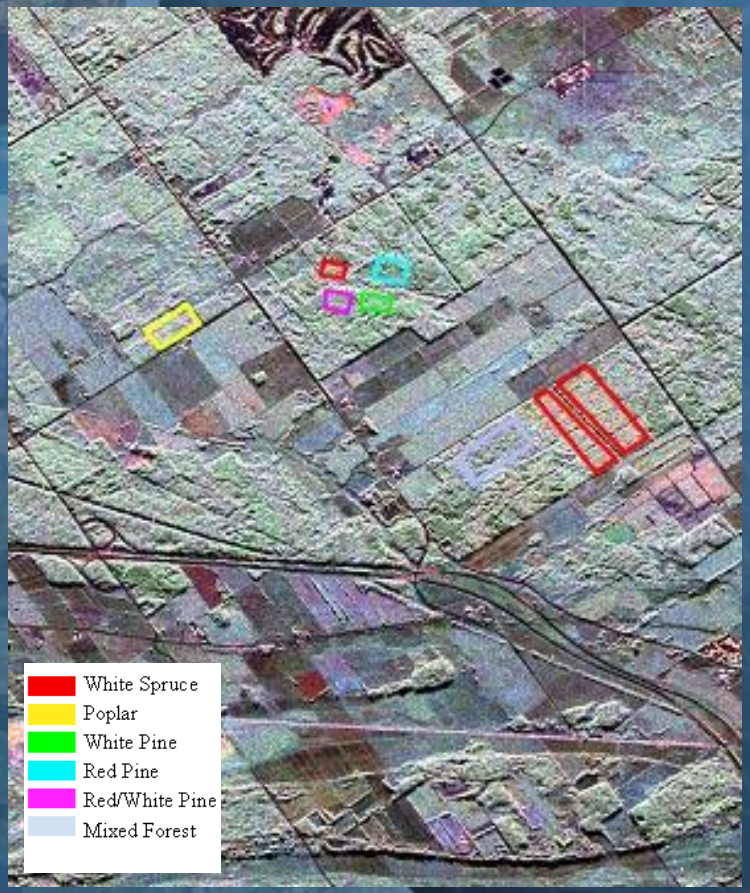
Resource Mapping:

- Terrain Analysis
- Forest Cover Type
- Land use

Commercial Forestry:

- Inventory Mapping
- Forest Damage Assessment
- Forest Management
- Utility Maintenance

SAR Applications



Forestry

Identification and Monitoring

- Use of polarimetric data is anticipated to improve the detection of structural differences between forest canopies and thus to help in forest type mapping and provision of additional information for other forest management applications

- False color composite image of the *Mer Bleue* study site near Ottawa , showing six forest areas with different species composition (C-SAR data, Red: HH, Green: HV and Blue: VV). Courtesy of CCRS.

Source: Canadian Centre for Remote Sensing 2008, Tutorial Radar Polarimetry Forestry Applications http://www.ccrs.nrcan.gc.ca/resource/tutor/polarim/apps3/00_e.php

SAR Applications

Maritime Applications

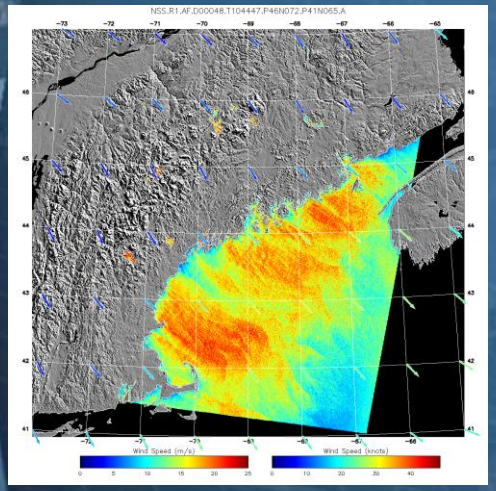
Environmental Assessment:

- High Resolution Ocean Winds
- Ocean Wave Climate
- Ocean Features & Currents
- Shorelines & shallow water topography

Maritime Surveillance

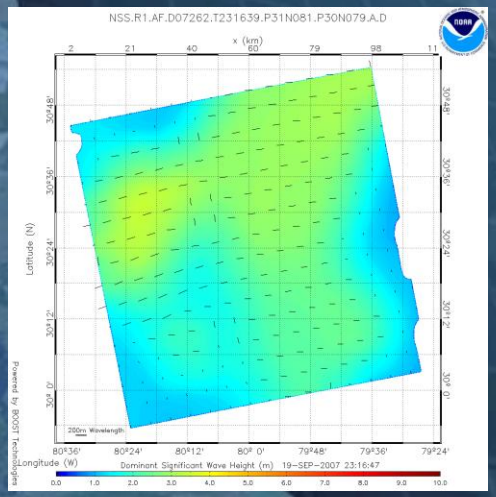
- Offsore Structures
- Shipping
- Port and Habor Security
- Disaster Mitigation

SAR Applications



Ocean Wind Climate

- *Power Generation*
- *Maritime Navigation & Hazards*
- *Spill Mitigation*



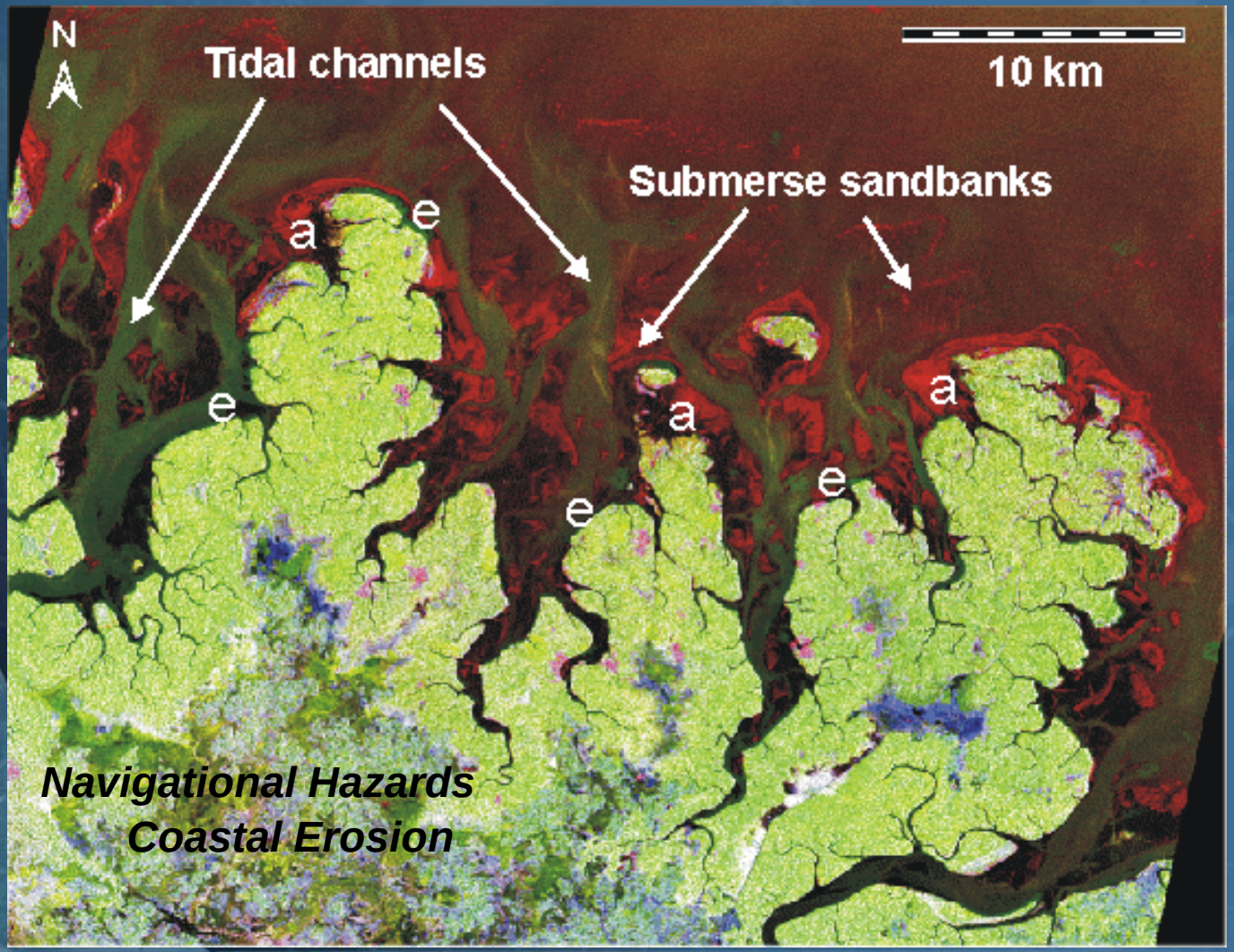
Ocean Wave Climate

- *Off Shore Structures*
- *Maritime Navigation & Hazards*
- *Beach & Shoreline erosion*
- *near shore Bathymetry*

MDA

MDA Information Systems, Inc.

SAR Applications



Potential of Polarimetry

Some Applications

- *Land Use Land Change*
- *Impervious Surfaces*
- *Infrastructure Monitoring & Maintenance*
- *Environmental Assessment*
- *Watershed Management*

Methods

- *Differential inferometery*
- *POLInSAR*
- *Coherent Change Detection*
- *Polarimetric Change Detection*

Summary

- Previous examples only highlight some of the uses for SAR Environmental Monitor
  - Utility Maintenance, Watershed studies and Management, Hydrologic studies and Modeling, Land Use/Land Classification
- Extraction Industries
  - Forestry, Oil and Gas, Mineral
- Insurance
  - Flood Mapping, Disaster assessment, Fire and Land slide probabilities
- Commodities
  - Forest Products, Agriculture, Energy
- Policy and policy enforcement
  - Fisheries, Agriculture, Land Use and Management, Urban planning and development, Carbon Credit Assessment