



# *ISTOP -The Integrated Satellite Tracking of Pollution Program*



---

**Laurie Weir**

Canadian Marine & Ice Service

Thanks to slide contributions from Doug Bancroft,  
Trudy Wohleben, Matt Arkett, Dr DeAbreu, Steve  
McCourt



Environment Environnement  
Canada Canada



# Outline

- Program Overview-linkages with partners
- Operational Work Flow
- Aerial Surveillance
- Early Results
- Time permitting a look at some of the new ice services available from CIS





# The Issue

- The illegal release of oily wastes poses a threat to the marine environment
- Catastrophic release of oil from vessel accidents or platforms is rare
- Accidental or illegal deliberate discharge at sea - frequent & in some places chronic
- **Some are dumping waste oils to avoid the time and costs associated with waste removal**



## ➤ Oiled Birds Continue to Wash Ashore

➤ 300,000 per year on the east coast

➤ What about the arctic?

➤ Important to have a monitoring program

In place





# ISTOP Inter-Departmental Program

**Environment Canada-** Canadian Ice Service, ER

**Transport Canada-** National Aerial Surveillance Program (NASP)

**Department of Fisheries and Oceans**— Coast Guard

**Canadian Space Agency**



## **Key Objectives**

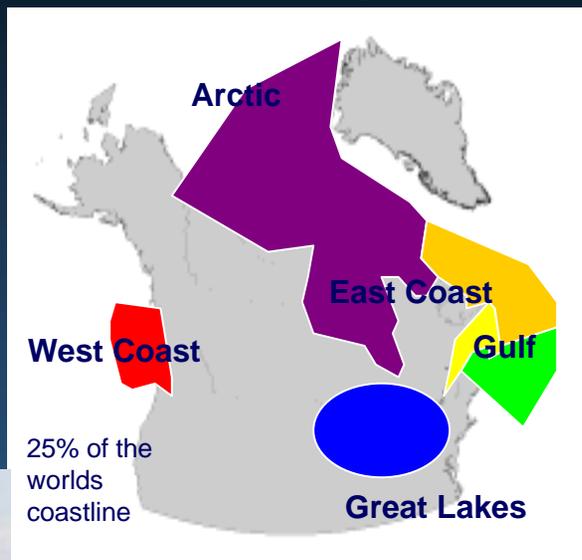
- **Improve surveillance of Canadian waters**
- **Identify the extent of marine oil pollution**
- **Reduce and deter the illegal release of oil**

*In terms of enforcement both Transport Canada and Environment Canada have regulatory jurisdiction and use evidence gathered by NASP crews to enforce the provisions of all Canadian legislation applicable to illegal discharges from ships, including the Canada Shipping Act, the Migratory Birds Convention Act & Arctic Pollution Regulation Act.*



# Mission-Oil Spill Deterrence

**ISTOP** is a satellite surveillance program for the detection of possible discharges of oil due to marine transportation and offshore oil production.



Ez-3.7 sq km



**ISTOP** uses RADARSAT ScanSAR Narrow satellite image information to vector surveillance aircraft to suspected marine pollution incidents to ascertain if there is an oil spill.



# RADARSAT vs. Aircraft Costs

## Aircraft

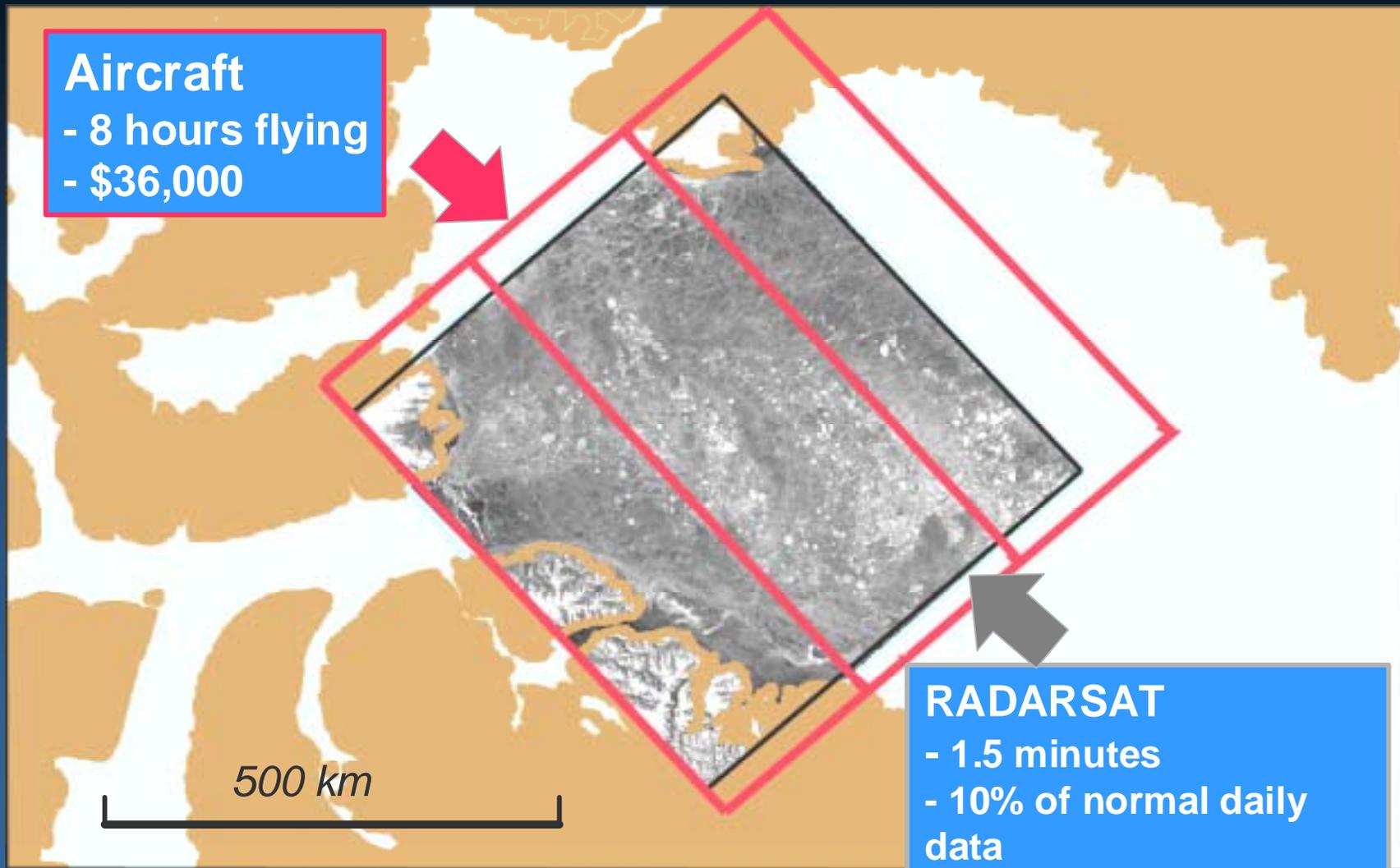
- 8 hours flying
- \$36,000



## RADARSAT

- 1.5 minutes
- 10% of normal daily data
- \$400

500 km





- November 2006 CIS becomes operational lead
- Acquire and process through current ice chain
- Remote sensing expertise

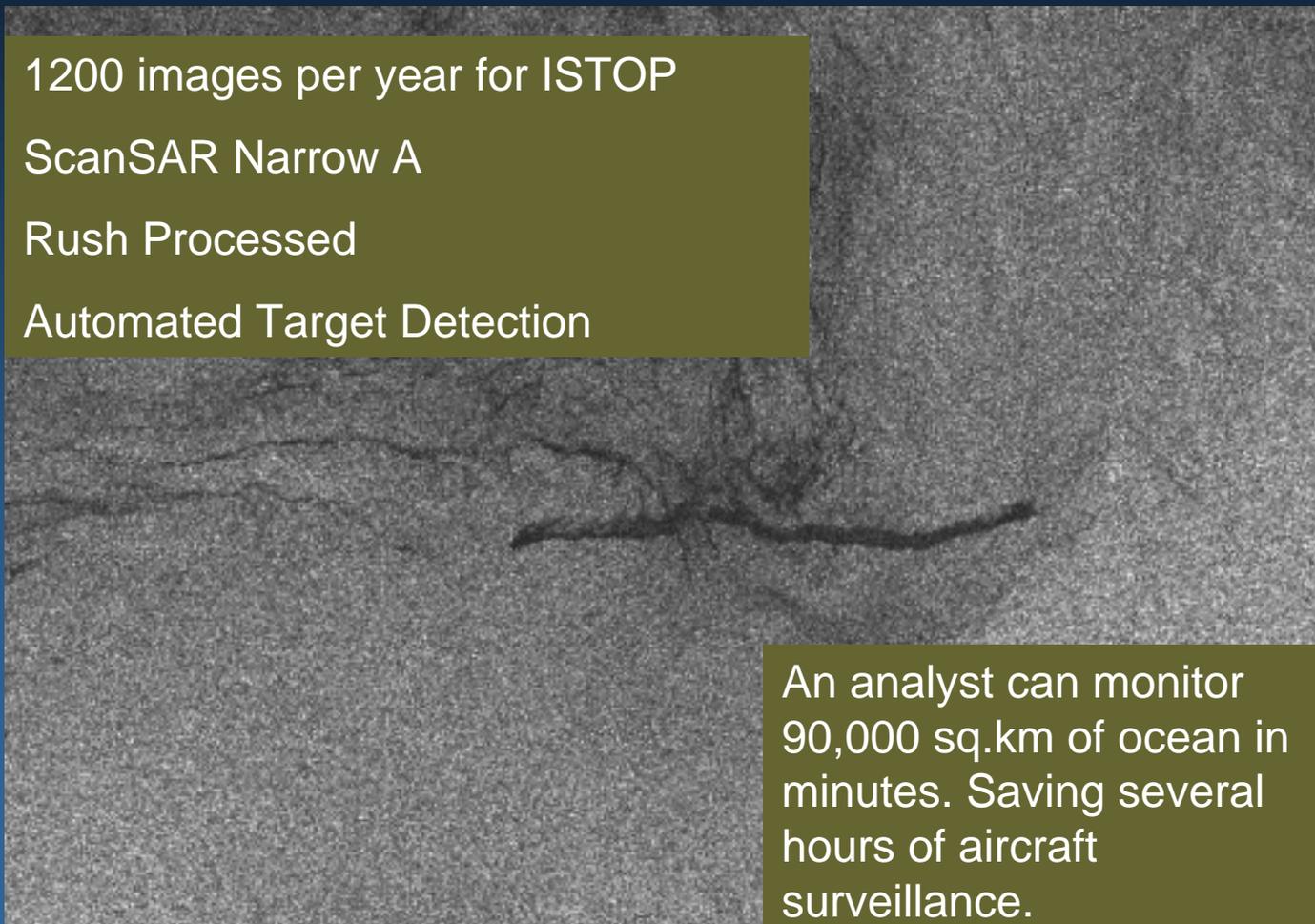


1200 images per year for ISTOP

ScanSAR Narrow A

Rush Processed

Automated Target Detection

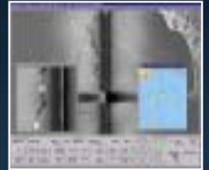


An analyst can monitor 90,000 sq.km of ocean in minutes. Saving several hours of aircraft surveillance.

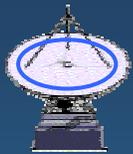


# Fast Data Turnaround Critical for ISTOP

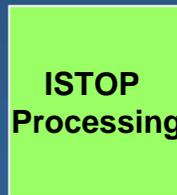
- ISTOP work flow is time-sensitive



- Goal – Near real time to allow aircraft to “ground-truth” and collect evidence
- Expedite response clean up activities
- Notification of port authorities to intercept vessels



CIS



ISTOP Processing



ISTOP Analyst



Products



CCG  
ROCs  
USCG

< 20 min.

35 min.

45 min.

60 min.

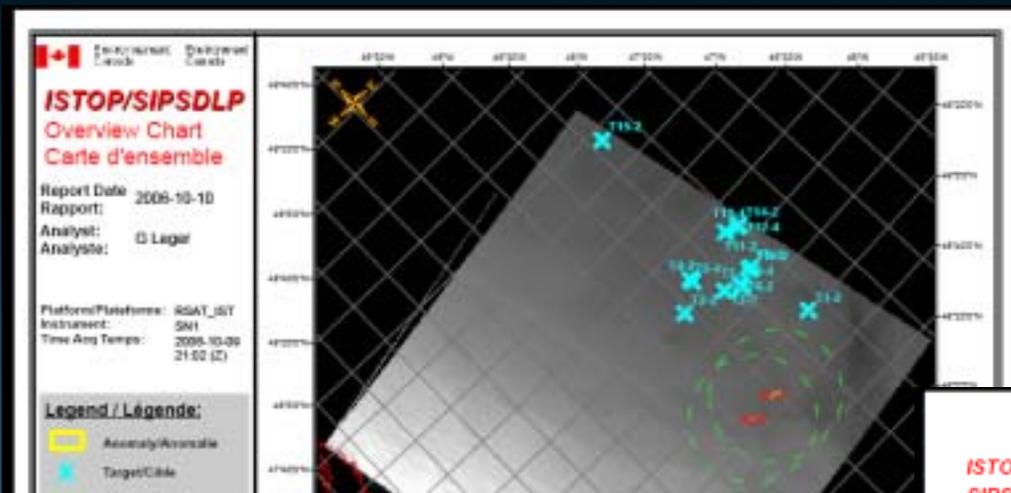
No Events

90 min.

Events



# ISTOP Product Suite



**ISTOP Anomaly Report**  
SIPSDLP Rapport d'anomalie

Report Date / Date du Rapport: 2006-10-10  
Analyst / Analyste: G Legar

**Data Source / Source des données:**  
 Scene ID / Scene: 050077  
Platform / Plateforme: RSAT\_IST  
Instrument: SM1  
Time Avg Temp: 2006-10-10 11:40:07 (Z)  
Obs at Date: 07007

**Image Coverage / Couverture de l'image:**  
 UL Lat/Lon: 47°02'N 47°02'W  
 UR Lat/Lon: 47°02'N 47°02'W  
 LL Lat/Lon: 47°02'N 47°02'W  
 LR Lat/Lon: 47°02'N 47°02'W

ID	Category / Catégorie	Lat/lon	Center Longitude	Area (km²)	Area (mi²)	Comments / Commentaires
A1	1	47°02'N 47°02'W	47°02'W	0.00000	0.00	1-Pol Avg, 07007-47-02N-47-02W
A2	1	47°02'N 47°02'W	47°02'W	0.00000	0.00	1-Pol Avg, 07007-47-02N-47-02W



**ISTOP Target Report**  
SIPSDLP Rapport de cible

Report Date / Date du Rapport: 2006-10-10  
Analyst / Analyste: G Legar

**Data Source / Source des données:**  
 Scene ID / Scene: 050077  
Platform / Plateforme: RSAT\_IST  
Instrument: SM1  
Time Avg Temp: 2006-10-10 11:41:12 (Z)  
Obs at Date: 07007

**Image Coverage / Couverture de l'image:**  
 UL Lat/Lon: 47°02'N 47°02'W  
 UR Lat/Lon: 47°02'N 47°02'W  
 LL Lat/Lon: 47°02'N 47°02'W  
 LR Lat/Lon: 47°02'N 47°02'W

Target ID / Cible	Lat/lon	Longitude	Confidence / Confiance*	Comments / Commentaires
T1	47°02'N	47°02'W	2	
T2	47°02'N	47°02'W	2	
T3	47°02'N	47°02'W	2	
T4	47°02'N	47°02'W	2	
T5	47°02'N	47°02'W	4	Hibers
T6	47°02'N	47°02'W	2	
T7	47°02'N	47°02'W	2	
T8	47°02'N	47°02'W	4	Henry Cooker

\* Target Confidence Level Legend / Légende du niveau de confiance de la cible:  
 1 - 40% confidence - 20% area apparent  
 2 - 60% confidence - 30% area apparent  
 3 - 80% confidence - 40% area apparent  
 4 - 90% confidence - 50% area apparent

Canadian Ice Service / Service canadien des glaces  
 Contact: icstop@gsi.ca 855-982-0812  
 #icecanada\_english

GIS shape files for database stats and modelling



# Partner National Aerial Surveillance Program



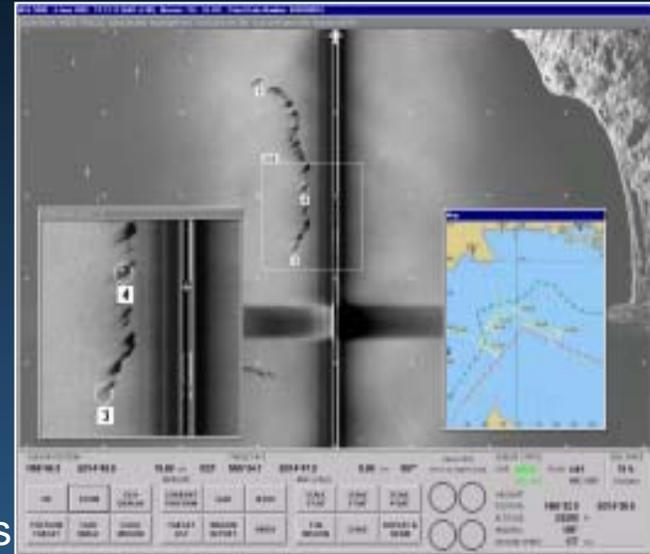
## TC Dash 8 – Moncton, New Brunswick

Pollution and ice reconnaissance in Atlantic, Quebec, Ontario Regions

•equipped with MSS6000 surveillance system

- SLAR
- FLIR infrared and UV line scanner
- AIS Automatic Identification sys.
- Camera system for video and stills

•1000 hours per year – 30 % night flights



## TC Dash 7 - Ottawa, Iqaluit, Inuvik



Ice reconnaissance & pollution surveillance in Canada's Arctic - 750 hours per year .. this summer ~100 hours per month– Navigable waters Hudson Strait through to Beaufort sea.

-visual surveillance only becoming night time capable Fall 07.





# NASP Resources / Area of Coverage

Weir



## TC Dash 8 – Vancouver,

Pollution surveillance in Pacific region with MSS600 sensors  
-on stream 2008  
-day & night capabilities



## TC Twin Otter – Vancouver, British Columbia

Pollution surveillance in Pacific Region but very limited range  
- 550 hours per year – visual surveillance only



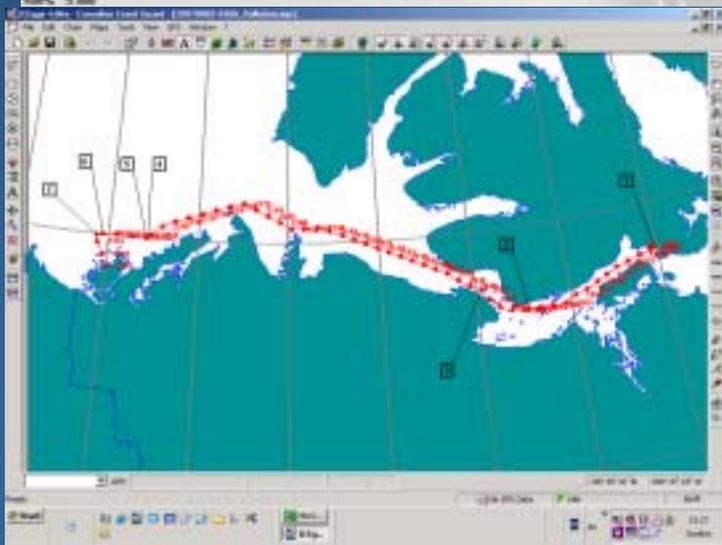
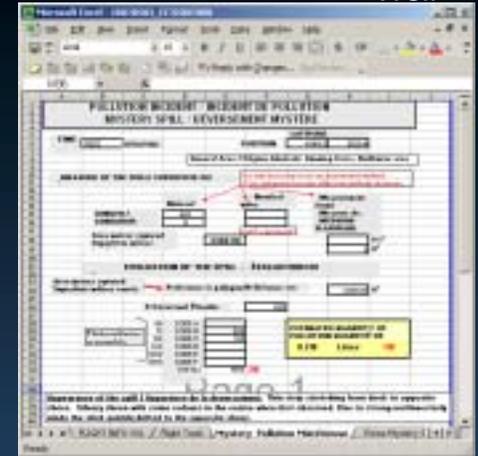
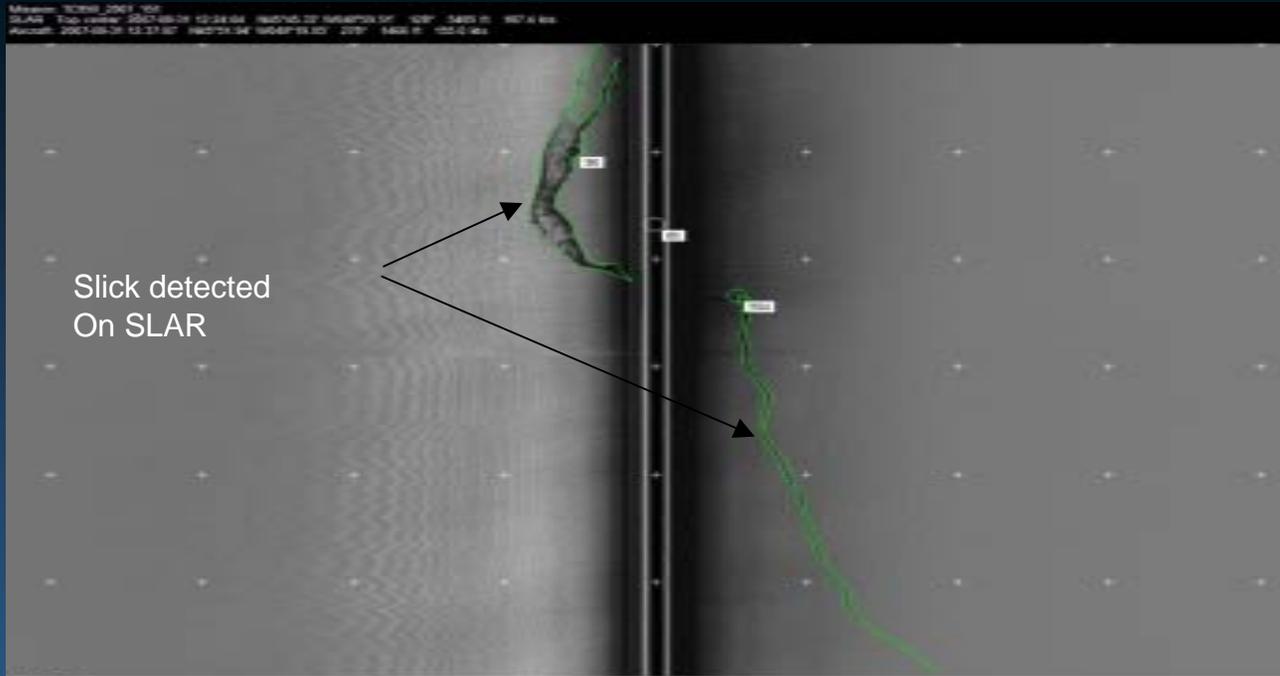
## Provincial Airlines King Air 200 - Contracted to DFO

Pollution surveillance in Newfoundland  
- 400 hours per year – remote sensing equipment



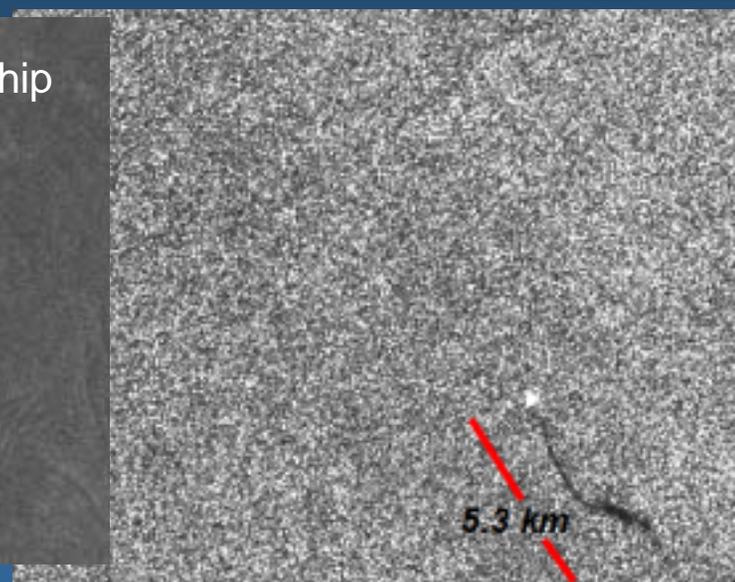
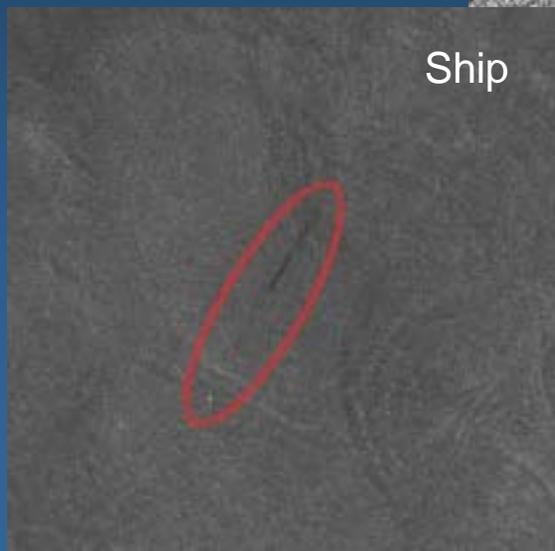
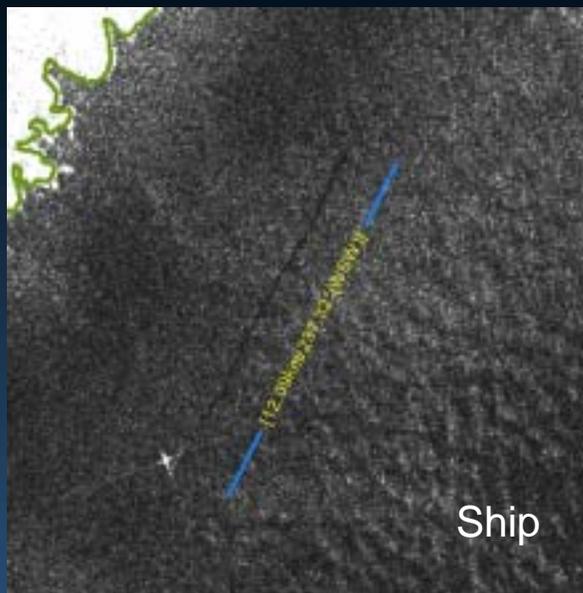


# Aircraft Products





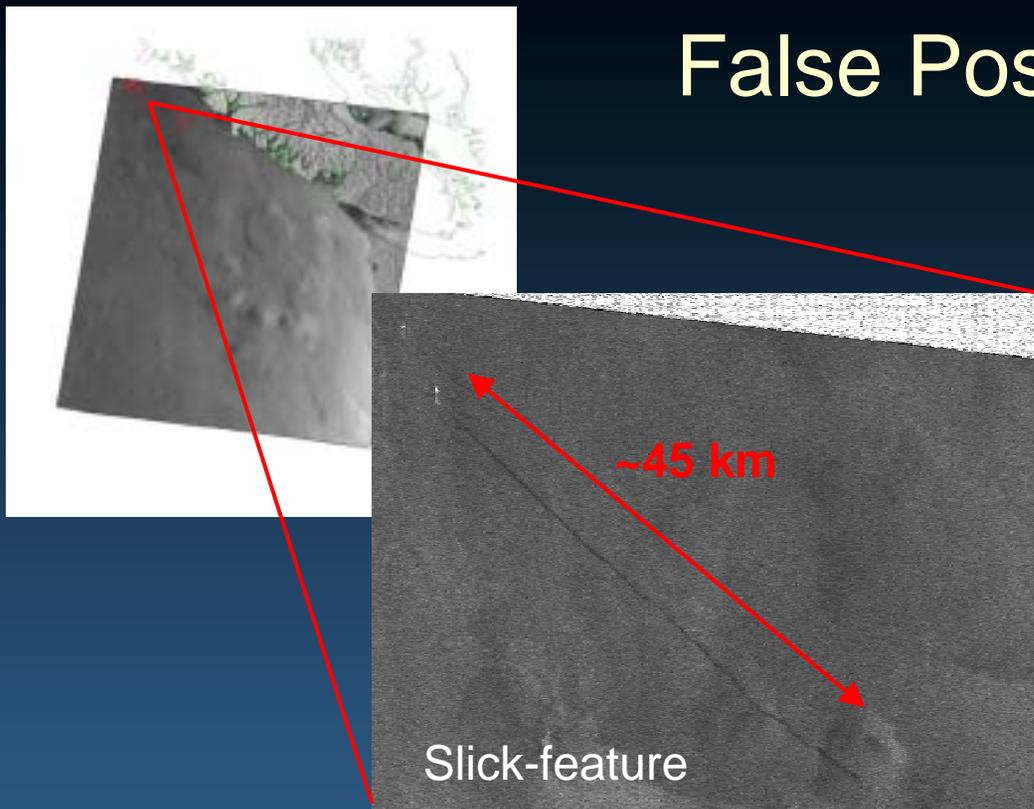
# Anomalies Detected



Platform



# False Positives



## Vancouver Island



An over flight, by a Transport Canada aircraft did not indicate the presence of oil as a potential cause of the slick-feature.

Post analysis pointed to Algae blooms. It is speculated that the slick-feature detected in the RADARSAT-1 image was due to the ship's propellers bringing plankton-rich water to the ocean surface.

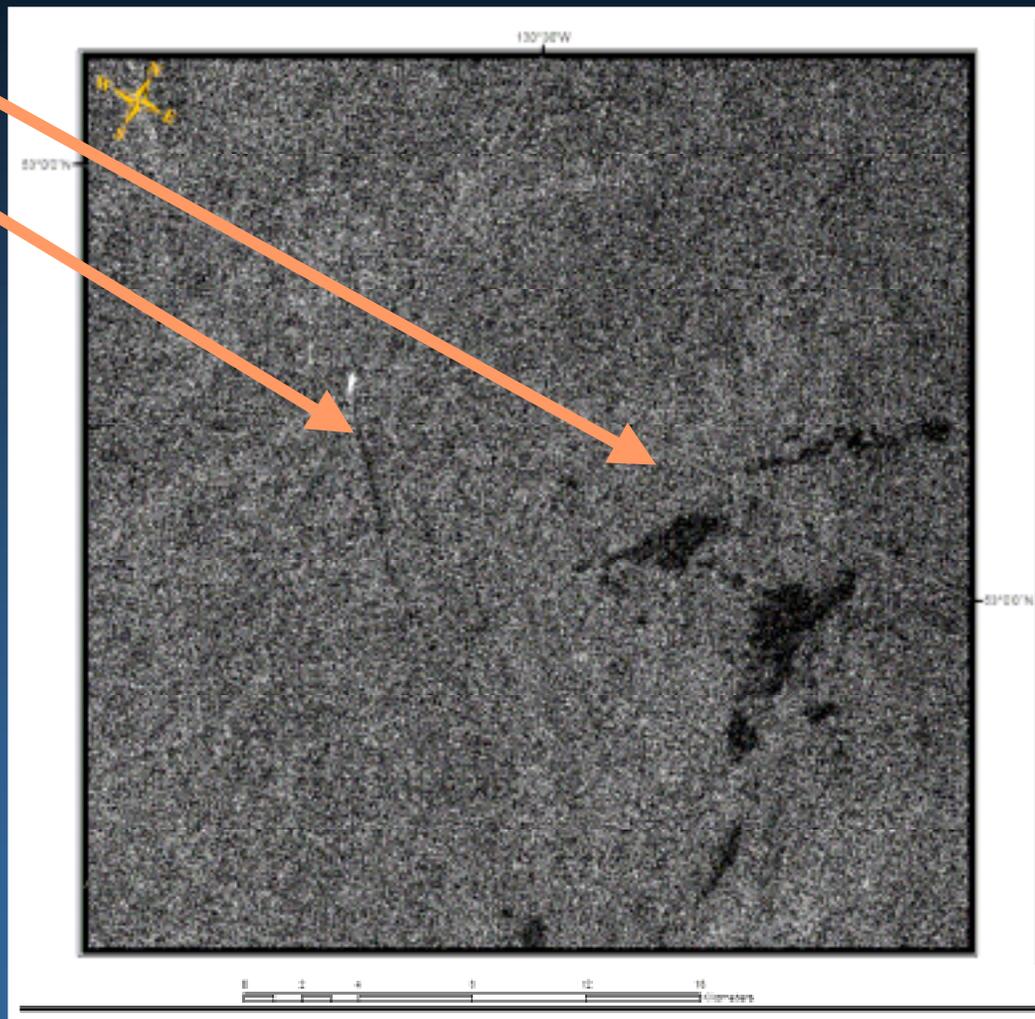
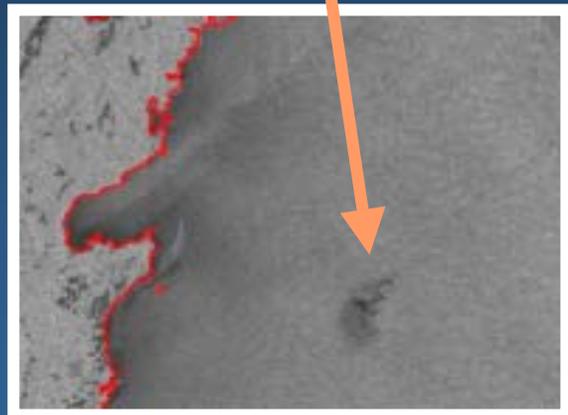
ScanSAR Narrow SAR image  
 acquired June 18, 2006  
 300 km x 300 km, 50 m resolution





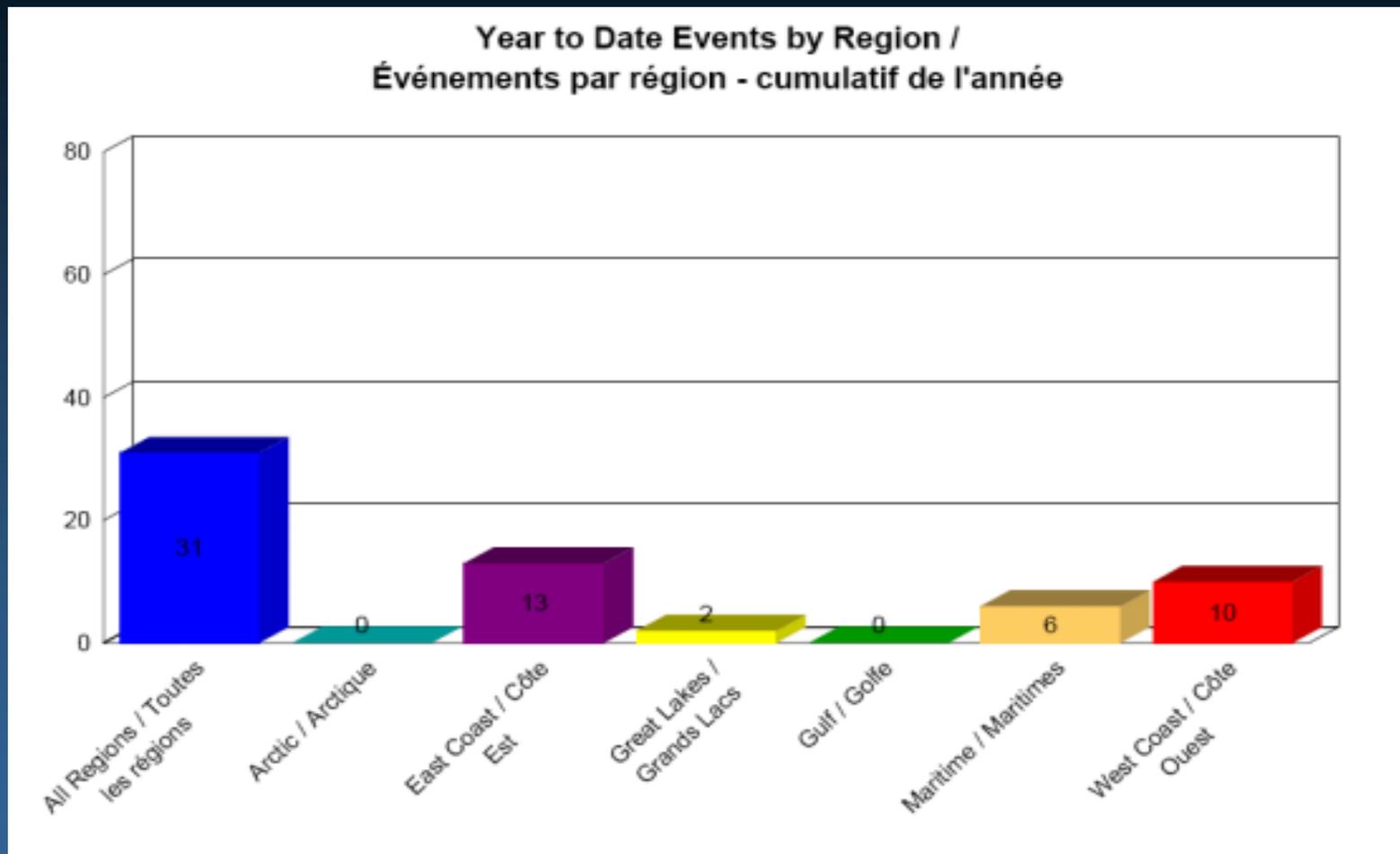
# False Positives

- Algae blooms
- Ship wakes
- Wind shadows
- Grease ice





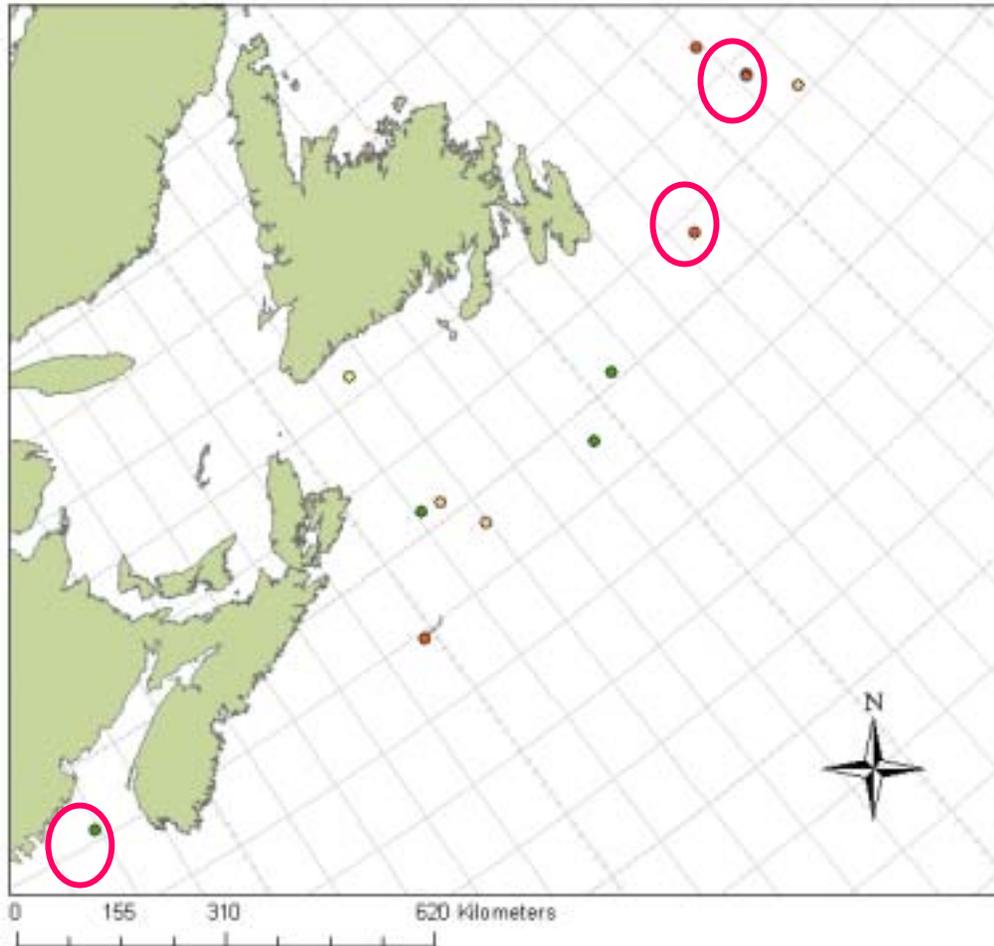
# Results-Fiscal Yr



- Arctic 2 spills were detected by NASP aircraft
- 493 images analysed April-Oct



### Location of Anomalies - East Coast (All anomalies since April 1, 2007)



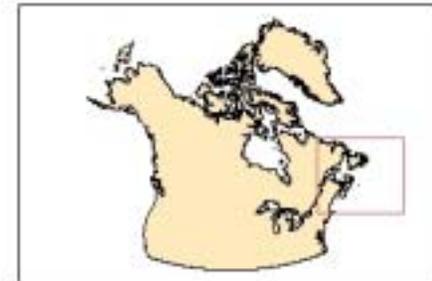
#### Legend

Anomalies - East Coast

#### Category

- 1
- 1A
- 1B
- 2
- 3

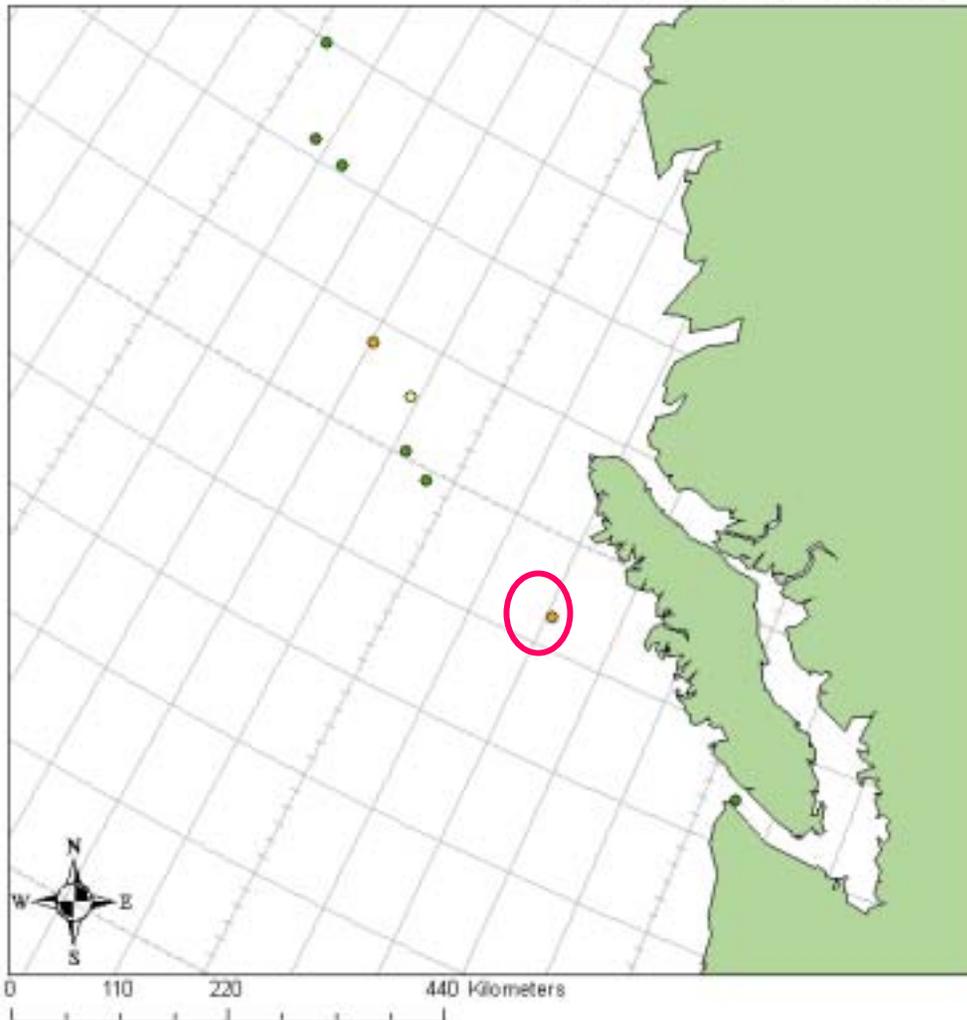
○ Aircraft Validated





# Location of Anomalies - West Coast

All anomalies since April 1 2007



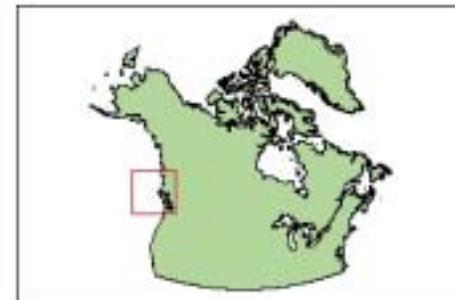
## Legend

### Anomalies - West Coast

#### Category

- 1
- 1A
- 1B
- 2
- 3

 Aircraft Validated





# Location of Anomalies - Great Lakes

All anomalies since April 1, 2007

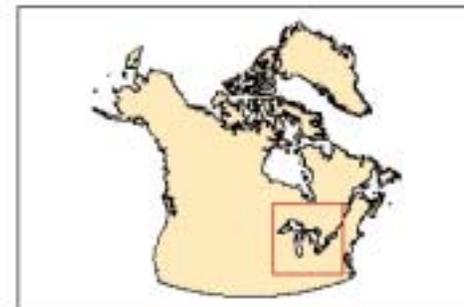
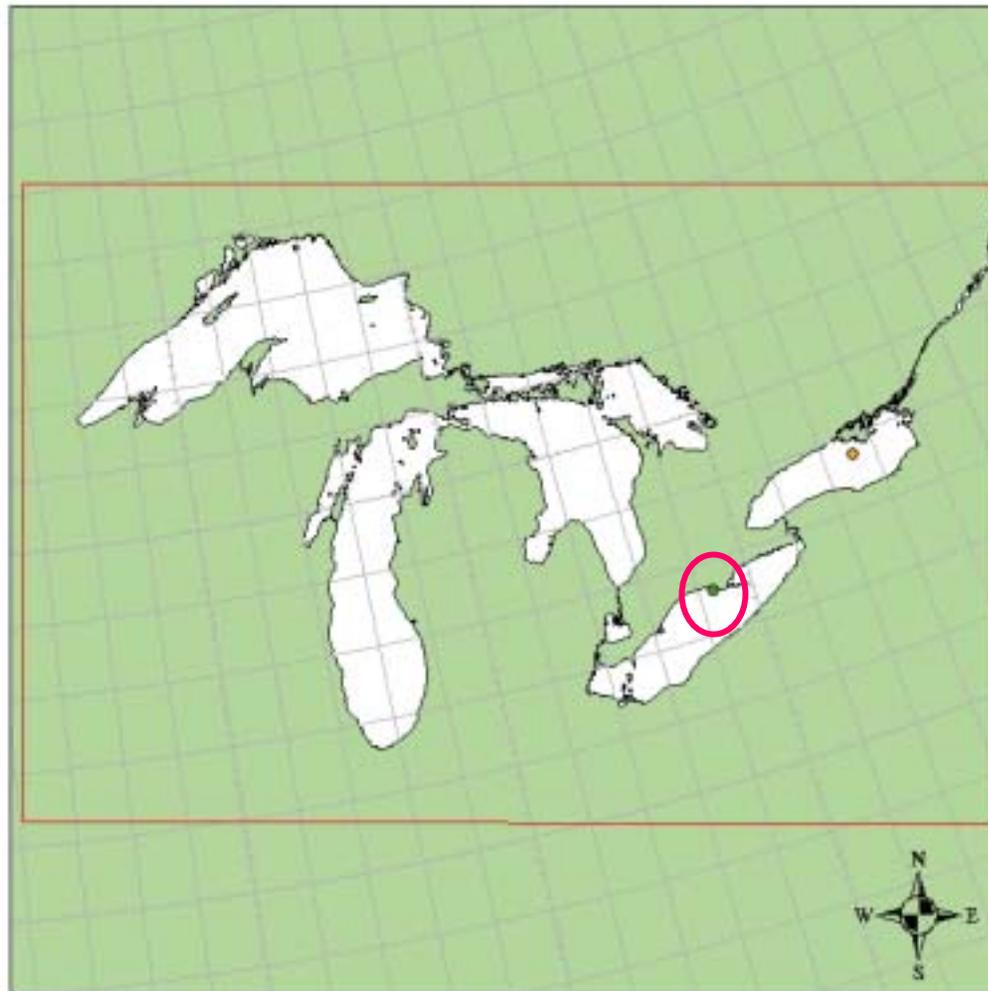
## Legend

### Anomalies - Great Lakes

#### Category

- 1
- 1A
- 1B
- 2
- 3

○ Aircraft Validated





# Summary

- ISTOP's integration of SAR satellite technology into oil pollution monitoring allows us to identify the extent of the problem- day & night and extended aerial coverage.
- Serves as a deterrence factor -reduce the illegal release of oily water
- Help mitigate the effects of the spill by vectoring clean up and enforcement personnel to the site NRT.

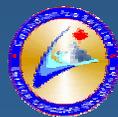
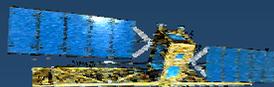




# The Canadian Marine & Ice Service

# Operational Sea Ice Services

## What's New



**Canadian Ice Service**  
 Meteorological Service of Canada



**North American Ice Service**  
 Canada, USA and the International Ice Patrol



Environment Environnement  
 Canada Canada



# North American Ice Service (NAIS)

Weir

## A Canada - US initiative

**Vision:** *create a harmonized suite of products and services for ice information to meet government needs for safety of navigation, security and informed decision making*

**RESULTS:**

***increase overall efficiency***

***streamlined business processes; non-duplication of effort***

***enhanced back-up capability; location independence of production***

***coordinated development, science and training***





# NAIS Canadian Component

- Mandate/Mission
    - Warn maritime users of hazardous ice conditions in Canadian waters
    - Maintain a general historic knowledge of ice conditions and ice climatology
  - Provides ice information in support of:
    - Ship routing
    - Icebreaking operations
    - Climate monitoring
    - Weather forecasting, & modeling
    - International Polar Year
- 50 years of ice reconnaissance service  
~30 years of ice forecasting



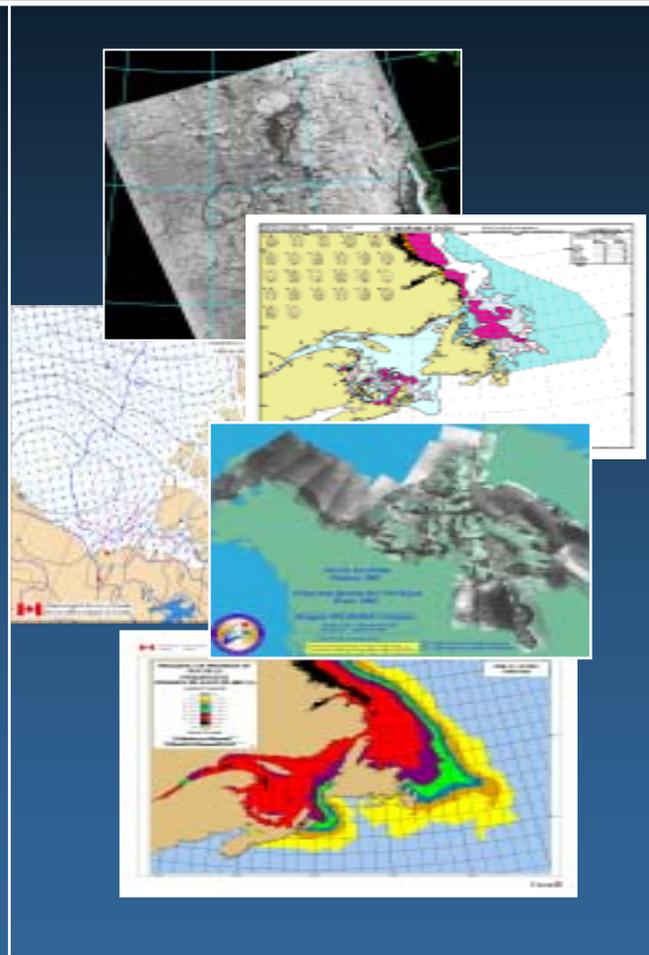


# Access to our Products

Canadian Ice Service Web Page-<http://ice-glaces.ec.gc.ca>

## Regular Products:

- Daily Ice Hazard Bulletins and warnings
- Daily Image analyses and daily/weekly composite charts
- Model ice drift and concentration
- Seasonal outlooks and 30-day forecasts
- Ice Atlases (climatic and annual)

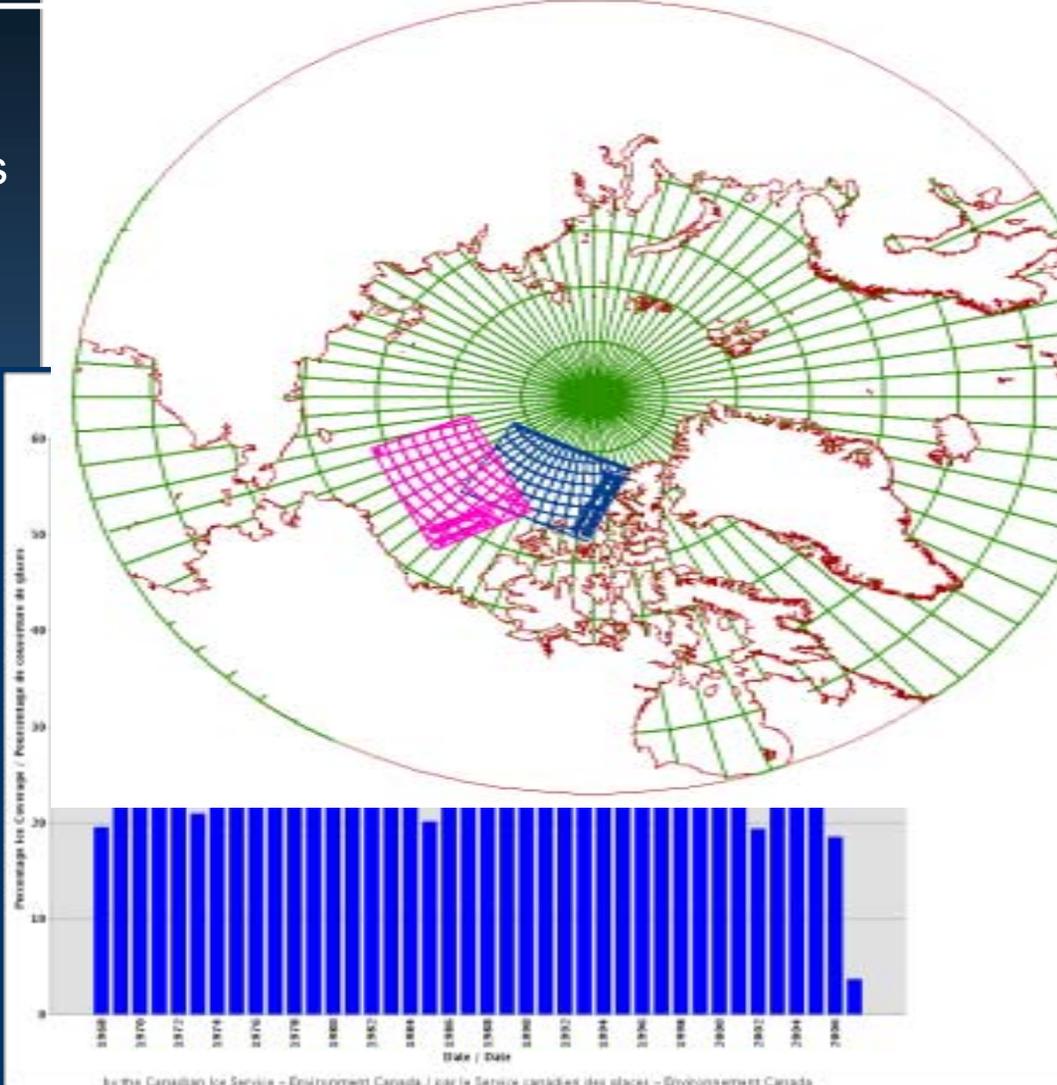




# NEW\*\* International Polar Year 2007-2009

- On-line access to the CIS archive- a large database of freely-available sea ice charts
- An extended digital sea ice database 1957-2009
- Access to the Radarsat1 image archive
- Radarsat-1 Image Mosaics: bi-weekly Mosaics
- Ice Graph Tool- time series analysis of ice conditions
- New Chart extents / projection
- RADARSAT & Quikscat animations
- Climatic Ice Atlases 1971-2000
- Expanded Annual Arctic Ice Atlas

Canadian Ice Service - Ice Graph Version 1.0



by the Canadian Ice Service - Environnement Canada / par le Service canadien des glaces - Environnement Canada



# Final Words

Visit us on line at

Canadian Ice Service Web Page-<http://ice-glaces.ec.gc.ca>

*Thank you to the organizers for the invitation*

*Questions?*