



Canadian Space Agency
Agence spatiale
canadienne

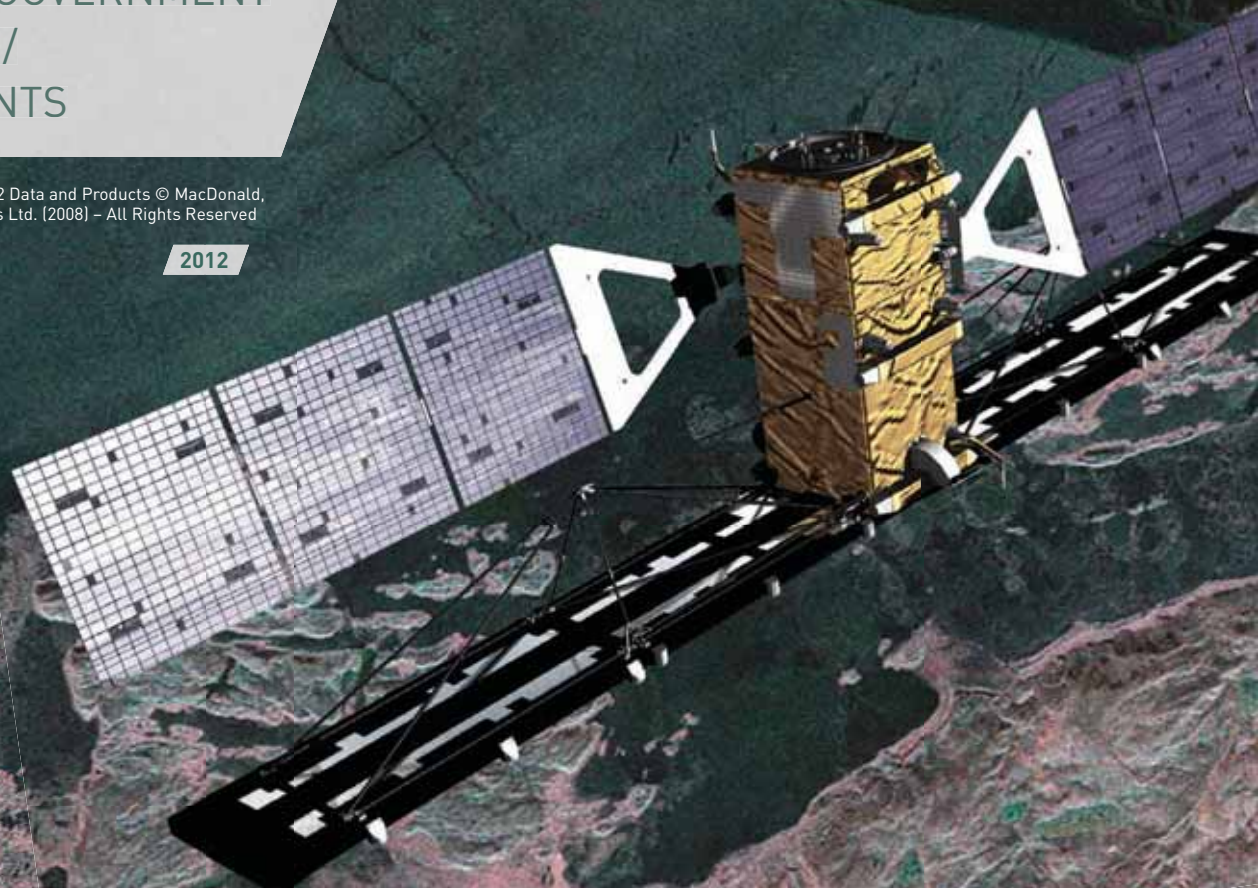


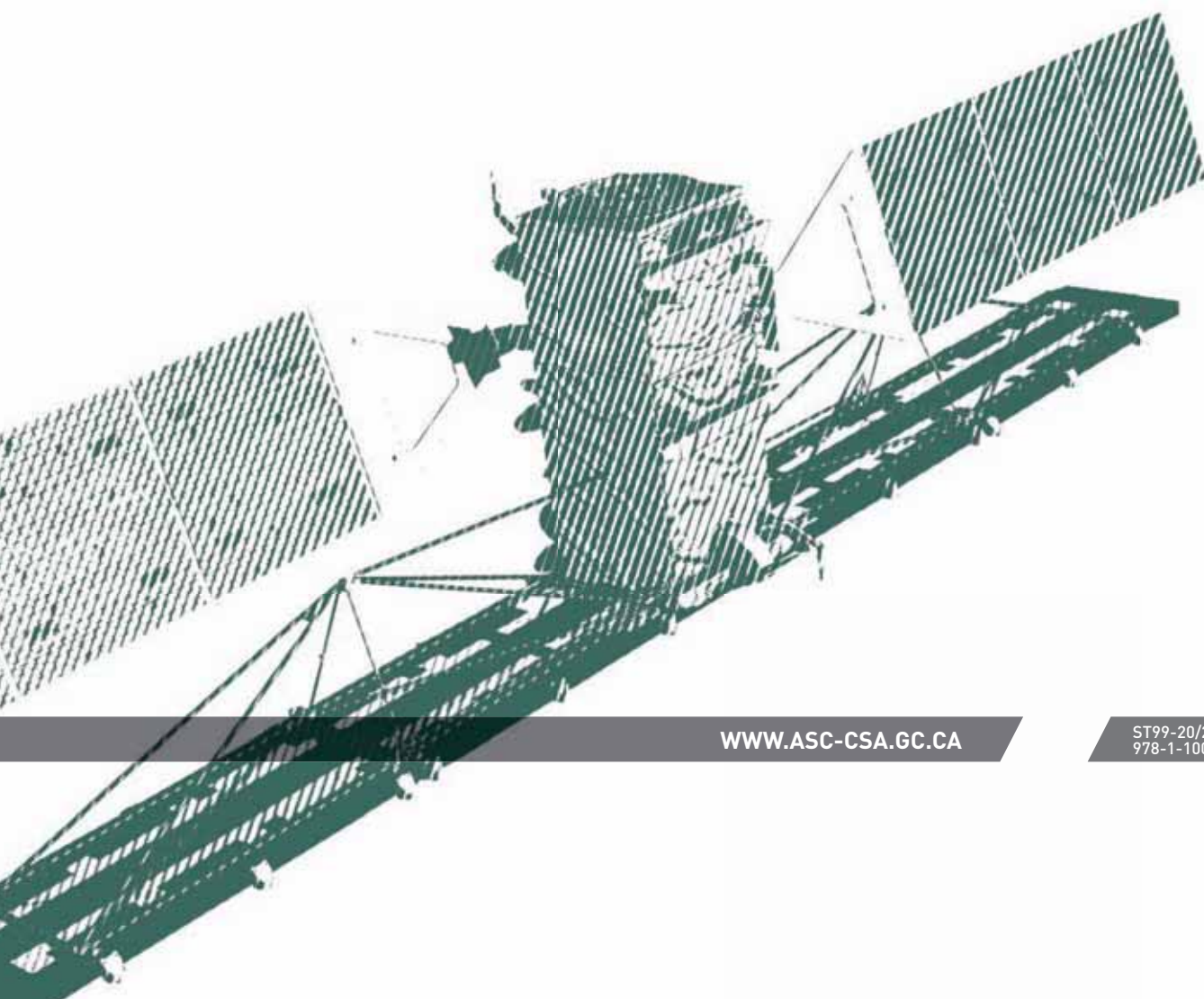
SPACE UTILIZATION EARTH OBSERVATION

SPACE APPLICATIONS
LINKED TO GOVERNMENT
PRIORITIES /
DEPARTMENTS

Source: RADARSAT-2 Data and Products © MacDonald,
Dettwiler and Associates Ltd. (2008) – All Rights Reserved

2012





SPACE SOLUTIONS FOR CANADIANS

The development of space-related Earth Observation (EO) applications, products and services are, by their very nature, driven by the evolving needs and priorities of Government departments, the private sector, academia and international collaboration in areas of mutual interest.

Early on, the Canadian Government established a space program tailored to meet its strategic priorities, such as ensuring our sovereignty and security, linking our communities, monitoring natural disasters and protecting our environment.

Science and technology positively impacts almost every aspect of our lives, helping us to solve problems and create opportunities. Scientific discoveries and new technologies provide solutions to many of the issues most important to Canadians, giving us the knowledge and the means to preserve the quality of our environment, protect endangered species, improve our health, enhance public safety and security, and manage our natural and energy resources. Scientific and technological innovations enable modern economies to improve competitiveness and productivity, giving us the means to achieve an even higher standard of living and better quality of life.

Clean air, land, and water are fundamental priorities of the Government of Canada. Space-based satellites capture and deliver data from a unique vantage point. It is the Earth Observation applications that transform that raw data into information of critical importance to people and society. The use of these specialised applications by Government departments and partners enhances their ability to protect citizens during natural and human-induced disasters, improves understanding of the environmental sources of health hazards, supports the management of energy resources, speeds the response to climate change and its impacts, safeguards precious water resources, improves the precision of weather forecasts, actively manages ecosystems, and promotes sustainable agriculture and the conservation of biodiversity.

The Canadian Space Agency coordinates and manages a number of complex and interrelated space and ground assets, and programs that produce EO applications, which in turn, delivers substantial economic, societal and environmental benefits for Canadians. Behind these applications lies the creativity and ingenuity of countless highly educated and specialised Canadians who are at the very foundation of the Canadian Space Program.

The Canadian Space Agency's Earth Observation Application and Utilization sector is working closely with other departments to stimulate the use and development of EO applications linked to governmental priorities and their specific mandates.

This document highlights the use of Earth Observation applications as a space solution to meet the priorities of the Agency's partners within Government, the private-sector, academia and the international community in nine societal benefit areas: (1) disasters; (2) health; (3) energy; (4) climate; (5) water; (6) weather; (7) ecosystems; (8) agriculture; and (9) biodiversity.

PREFACE	1
DISASTER MANAGEMENT	
1. Support to Flood Monitoring and Response Activities	3
2. Detecting Illegal Oil Discharges in Canada's Coastal Waters	6
3. Monitoring and Reporting on Forest Fires Activity on a National Scale	8
4. Assessment and Mitigation of Active Geohazard Sites	10
5. Rapid Mapping of Hurricane Impacts – <i>Strengthening Regional Security in the Caribbean</i>	12
HEALTH	
6. Evaluating the Risks of Microbial Contamination in Recreational Waters	15
ENERGY AND MINING	
7. Monitoring Unstable Areas	17
CLIMATE	
8. Monitoring Cryosphere Changes	19
WATER	
9. Strengthening Maritime Surveillance and Ship Detection	21
10. Water Prospecting and Resource Management	23
11. Space: Supporting Ecosystem Management	25
12. Ensuring Safe Navigation in Canada's Icy Waters	27
13. Monitoring Harmful Algae in Canadian Waters	29
WEATHER	
14. Canada's Coastal Zones: <i>Enhancing Marine Wind and Weather Forecasts</i>	31
ECOSYSTEMS	
15. Supporting Sustainable Agriculture	33
AGRICULTURE	
16. Monitoring Ecological Integrity of Arctic National Parks	35
BIODIVERSITY	
17. Improving Wildlife Management And Enforcement	37
PARTNERING DEPARTMENTS	39

APPLICATION

1

SUPPORT TO FLOOD MONITORING AND RESPONSE ACTIVITIES ///**A. DESCRIPTION**

Floods are one of the most costly natural disasters in Canada in terms of property damage. They can occur in any region, in the countryside or in cities, at virtually any time of the year. They have affected hundreds of thousands of Canadians. Excessive precipitation, ice jams, coastal storms, soil moisture conditions and snowmelt are the main factors of flooding. Floods also occur along the shoreline of lakes and oceans when water rises after high runoff, during storm surges or the hammering of waves. Fluctuations in water levels are natural occurrences. People generally relate high-water levels to flood conditions if the water threatens homes and lives, industry and our critical infrastructure (such as bridges, roads, pipelines and power sources). Since inception in 1970, the Disaster Financial Assistance Arrangements (DFAA) have been applied to over 170 events, with a total federal contribution of over \$1.9B. The DFAA have been applied to a number of spring floods in Manitoba and Saskatchewan caused by snowmelt and heavy or sustained precipitation.

B. SPACE SOLUTION

When applied to flood monitoring and response activities, RADARSAT data is used to help assess the impact of floods, predict the extent and duration of flood waters, analyze the environmental impacts and support the development and implementation of flood mitigation measures. The ultimate purpose of using RADARSAT data and products to support emergency management is to save lives, preserve the environment and protect property and the economy.

C. GOVERNMENTAL PRIORITIES

- Strengthening Canada's National Security
- Helping Canadians facing a crisis and emergencies
- National Disaster Mitigation
- Protecting lives through prevention
- Enhancing economic and social viability by reducing disaster impacts

D. PARTNERING DEPARTMENTS

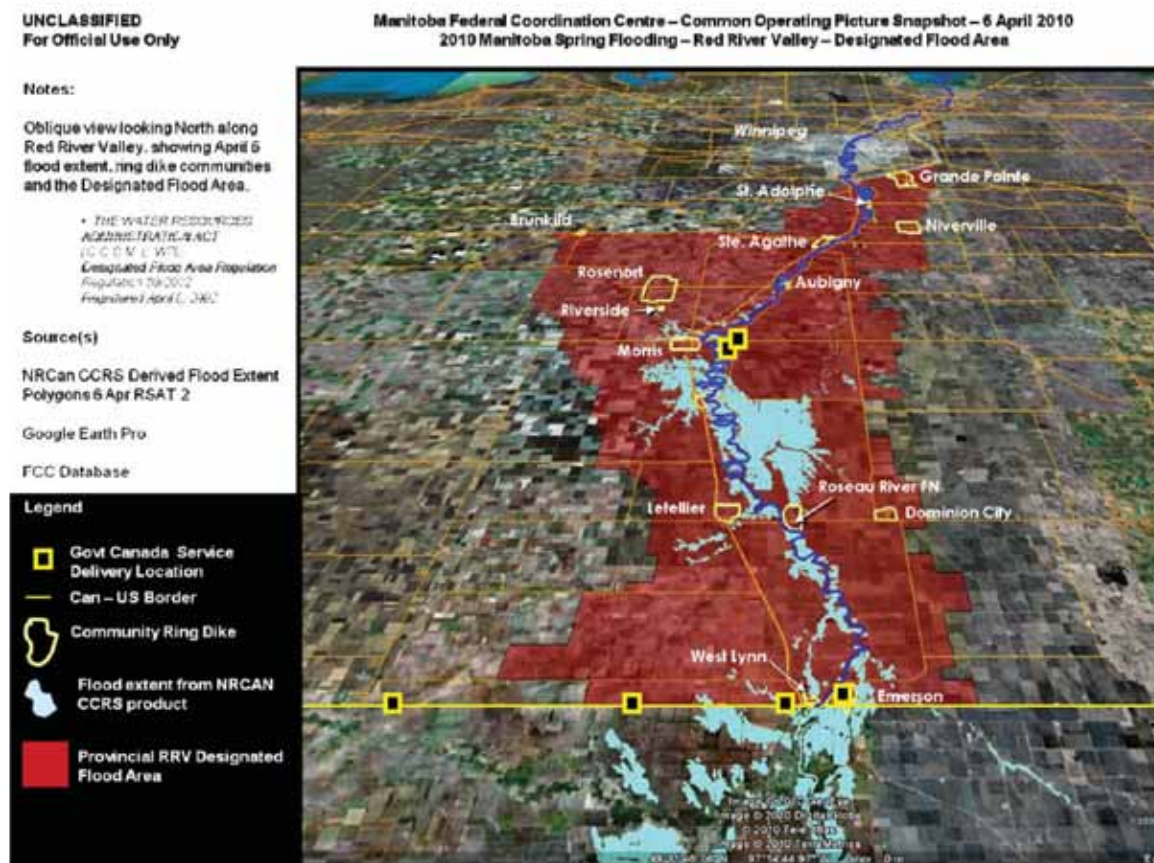
- Public Safety Canada
- National Defence
- Agriculture and Agri-Food Canada
- Natural Resources Canada (Canadian Center for Remote Sensing)

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Flooding in Manitoba – 2010



RADARSAT-2 images were acquired in April 2010 over southern Manitoba during the flood of the Red River. The flood products were developed and used by Public Safety to better manage and respond to the event on the ground.

Oblique view looking North along the Red River Valley (Manitoba, Canada), showing the flood extent (blue), the communities ring dikes (yellow) and the provincial designated flood areas (red). All this information, derived from RADARSAT-2 imagery, is now accessible via a Google Earth application to better monitor and manage the flood.

Flooding in Saint-Jean-sur-Richelieu – 2011



(Source: Canadian Space Agency, NASA, 2011)

This series of three satellite images shows the recent flooding along the Richelieu River in Quebec on May 8, 2011.

The first two are natural colour and infra-red images acquired by NASA's EO-1/ALI at 10 and 30 meters, resolution respectively. The third one is a radar image acquired by the Canada's RADARSAT-2 at a resolution of 25 meters.

All three images cover the same area: the northernmost portion of Lake Champlain, the severely flooded banks of the Richelieu River, as well as settlements, agricultural landscapes and towns along its course, such as Saint-Paul-de-l'Île-aux-Noix, Saint-Jean-sur-Richelieu and Chambly.

Both ALI and RADARSAT imagery show the extent of the flood along the river very well in dark blue and in black image tones, respectively. The multispectral ALI imagery clearly reveals various types of vegetation and land cover; for example active vegetation growth is depicted in bright green on the infra-red image, and mostly bare or sparsely covered ground surfaces are revealed in shades of pink and beige colours. Clouds and cloud shadows are noticeable in some portions of the ALI imagery.

Radar offers the advantage of cloud-penetration and therefore offers more reliable imaging capabilities. In addition to the very dark water surfaces, the RADARSAT-2 image clearly reveals many buildings and settlement areas in contrasting bright image tone ("corner reflections"); bright image tone is also indicative of flooded vegetation in the Richelieu River flood plain and some wetlands along Lake Champlain.

APPLICATION

2

DETECTING ILLEGAL OIL DISCHARGES IN CANADA'S COASTAL WATERS ///

A. DESCRIPTION

Off the coast of Atlantic Canada and following the circle route, more than 10,000 ships travel every year between North America and Europe. While only a small fraction of these vessels spill or deliberately dump oil, the environmental toll is enormous. Canada's I-STOP program (Integrated Satellite Tracking of Polluters) is now actively monitoring our waters using RADARSAT imagery. In November 2006, Canada began to operationally monitor marine coastal areas for oil pollution with RADARSAT-1 using its Synthetic Aperture Radar. The implementation of this program by the Canadian Ice Service of Environment Canada follows the highly successful ISTOP program sponsored by the Canadian Space Agency's Government Related Initiatives Program. The operational ISTOP program uses RADARSAT data to identify potential oil spills to vector aerial and surface response efforts.

B. SPACE SOLUTION

Conventional monitoring of Canada's territorial waters by aircraft is both costly and time-consuming. It is impossible to monitor every ship navigating our waters using aircraft. This is where satellites complement traditional air surveillance. But unlike aircraft and optical satellites, RADARSAT operates and captures images during storms, through cloud cover, and at night – that is, in conditions that blind optical imagers. And RADARSAT is quick to respond, which is essential when polluters try to flee the scene. Through the I-STOP program, RADARSAT scans for anomalies on the water surface that may indicate oil spills. Technical experts examine images and if required, an aircraft is sent to confirm the spill, identify the offending ship, and gather evidence in support of future legal action. With readily available data from space, the enforcement work can be completed in hours. Active communication of this program is delivering results – the shipping industry now knows that Canada is serious about protecting its waters and is using sophisticated satellites to track illegal actions. The radar monitoring of our waters is therefore a very effective deterrent and as a result a prosecution was completed based on this technology. Furthermore, the successful I-STOP program has attracted the attention of other nations interested in protecting wildlife, coastal regions, and oceans.

C. GOVERNMENTAL PRIORITIES

- Reducing illegal oil discharges in Canada's coastal waters
- Restoring, conserving and enhancing Canada's natural capital
- Reducing environmental risks and contributing to the well being of Canadians
- Protecting the environment from the effects of pollution and waste oil
- Monitoring, conserving, and protecting aquatic ecosystems and habitats

D. PARTNERING DEPARTMENTS

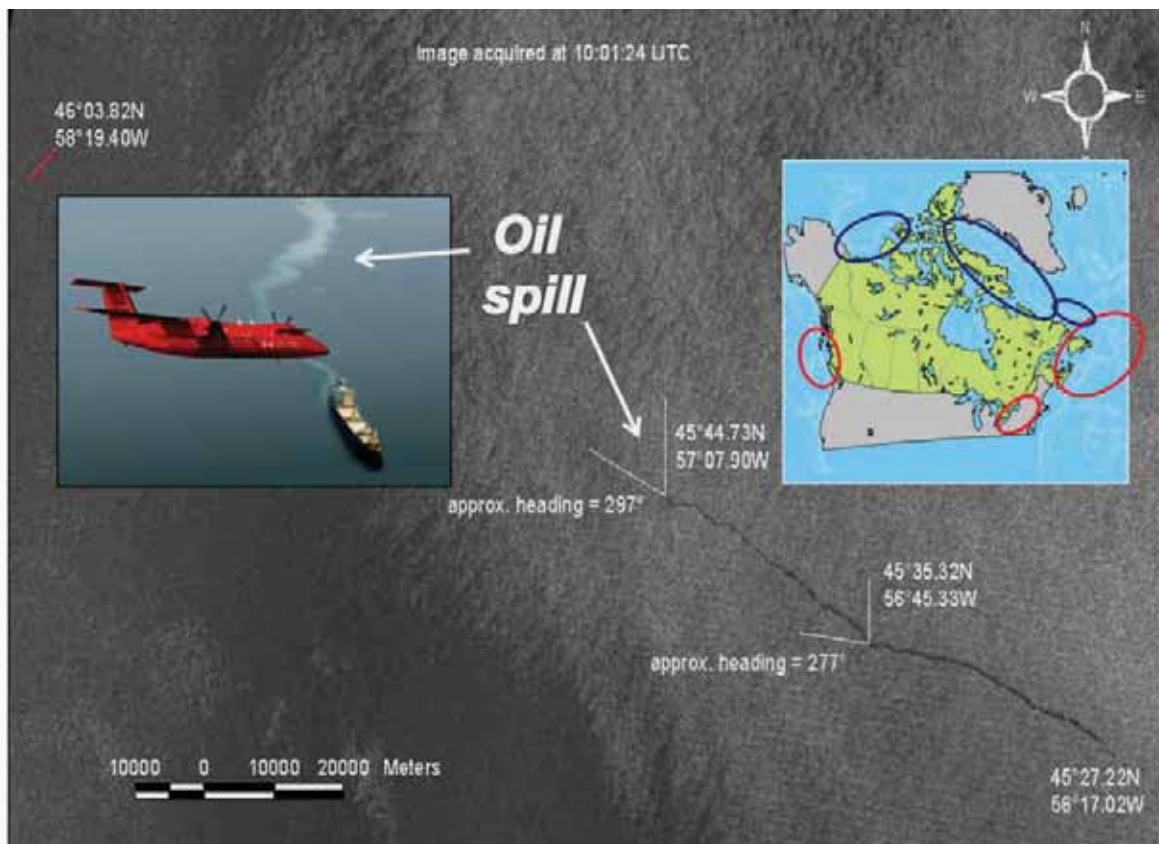
- Environment Canada
- Transport Canada
- Department Fisheries and Oceans
- Coast Guard
- National Defence
- Justice Canada

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

I-STOP Program – Oil Spill Monitoring



[Source: Environment Canada, 2011]

Through the I-STOP program, RADARSAT-1 and RADARSAT-2 scan zones of navigation (see image in upper right) for anomalies on the water surface that may indicate oil spills (the black line on the radar image). Technical experts examine these images, and if warranted, an aircraft is sent to confirm the spill, identify the offending ship, (images upper left) and gather evidence in support of future legal action. Source: NRCAN, AGS, CSA, 2010.

APPLICATION

3

MONITORING AND REPORTING ON FOREST FIRE ACTIVITY ON A NATIONAL SCALE ///

A. DESCRIPTION

Fire plays an important role in Canada's forest ecosystems. As these ecosystems have evolved since the glacial retreat at the end of the last ice age, over the last 10,000-15,000 years, fire has helped to maintain their health and diversity. However, from a socio-economic perspective, fire can also produce negative or undesirable effects on public health and safety, property, and natural resources. The purpose of the Canadian Wildland Fire Information System (CWFIS) is to report national fire statistics, support the development of a reliable and defensible forest fire emissions reporting system, and support Canada's policy, decision making and strategy related to our reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto protocol. The Canadian Wildland Fire Information System is also a key contributor of information used by the National Forest Carbon Accounting System and Environment Canada's Greenhouse Gas Division through the Monitoring, Accounting, and Reporting System.

B. SPACE SOLUTION

CWFIS is a system that uses satellites and forest fire data to track and report on the carbon emissions generated by wildfires. Satellites are used to detect high-temperature areas called "hotspots". Data on these hotspots – details such as the location, size and energy of active fire fronts – provide critical information for the forest managers who monitor wildfires, and those who calculate carbon emissions from those fires.

Canada is one of the first countries to implement a national system capable of reporting annual carbon emissions from wildfires. A system of this calibre is indispensable in helping Canada fulfill its reporting obligations under the United Nations Framework Convention on Climate Change. The information from CWFIS also supports other areas of forest management, such as forest certification, criteria and indicators.

C. GOVERNMENTAL PRIORITIES

- Promoting the sustainable development of Canada's forests and the competitiveness of the Canadian forest sectors
- Reducing the impacts of natural disasters
- Providing National and regional support during emergency situations
- Contributing to safety and well-being of Canadians
- Protecting the health of Canadians and improving outdoor air quality
- Supporting Canada's International treaty obligations

D. PARTNERING DEPARTMENTS

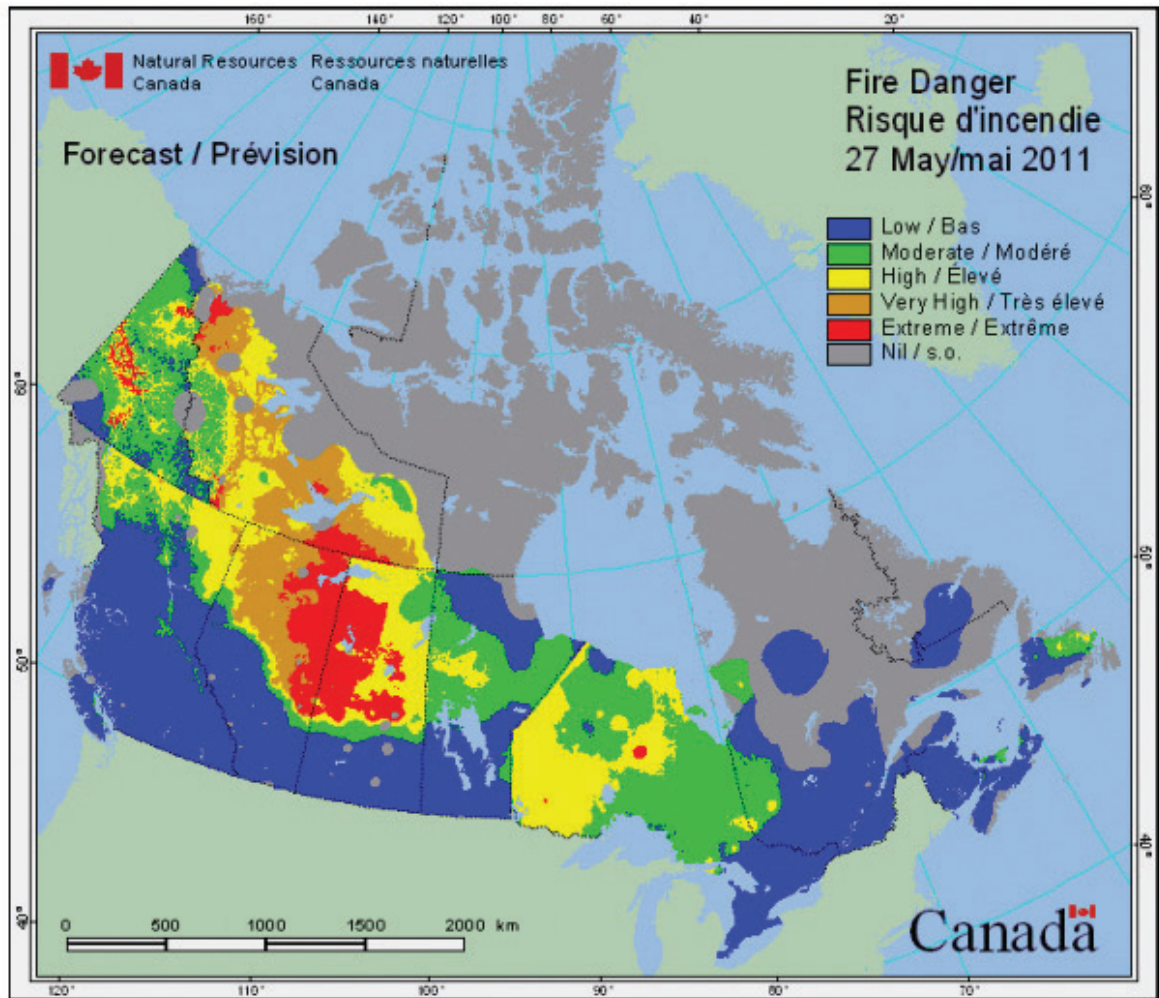
- Natural Resources Canada (Canadian Forest Service)
- Environment Canada
- Department of Foreign Affairs and International Trade

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Fire danger map



MODIS, 250 m Resolution

Fire Danger Map-May 27th 2011: produced with MODIS imagery and derived from the Canadian Wildland Fire Information System showing the fire danger risks on a national scale.

APPLICATION

4

ASSESSMENT AND MITIGATION OF ACTIVE GEOHAZARD SITES ///**A. DESCRIPTION**

The only active plate margin in Canada is located in coastal British Columbia. The ongoing collision of tectonic plates and the steep mountainous topography means that earthquakes and landslides are common occurrences. Tsunamis and volcanoes also pose a hazard. In Alberta, people and infrastructure are at risk from landslides. Assessment and mitigation activities are needed by the Government of Canada to help monitor and reduce the consequences of such events and increase the safety of our communities and critical infrastructure.

B. SPACE SOLUTION

InSAR deformation monitoring as a routine hazard assessment method is in its early stage of development in Canada. There is a need to develop convincing case studies at difficult high-risk sites that will be used to establish an InSAR monitoring baseline for continuous integrated monitoring along Canada's strategic transportation and energy corridors. The project objectives are: (1) to produce InSAR products of active landslide areas along strategic transportation and energy corridors, and of selective seismically active areas in Canada; (2) produce an InSAR image archive of selected active geohazard areas in Canada. It should also be noted that this technology is currently used operationally in the Oil & Gas industry.

C. GOVERNMENTAL PRIORITIES

- Assessing and mitigating geohazard activities in Canada
- Minimizing the loss of life and property from natural disasters
- Increasing the awareness of landslide hazards in Canada
- Assisting professionals who require information, data and expertise on landslides
- Increasing the safety of our communities and critical infrastructures

D. PARTNERING DEPARTMENTS

- Natural Resources Canada (Geological survey Canada)
- Public Safety Canada

E. FOR MORE INFORMATION

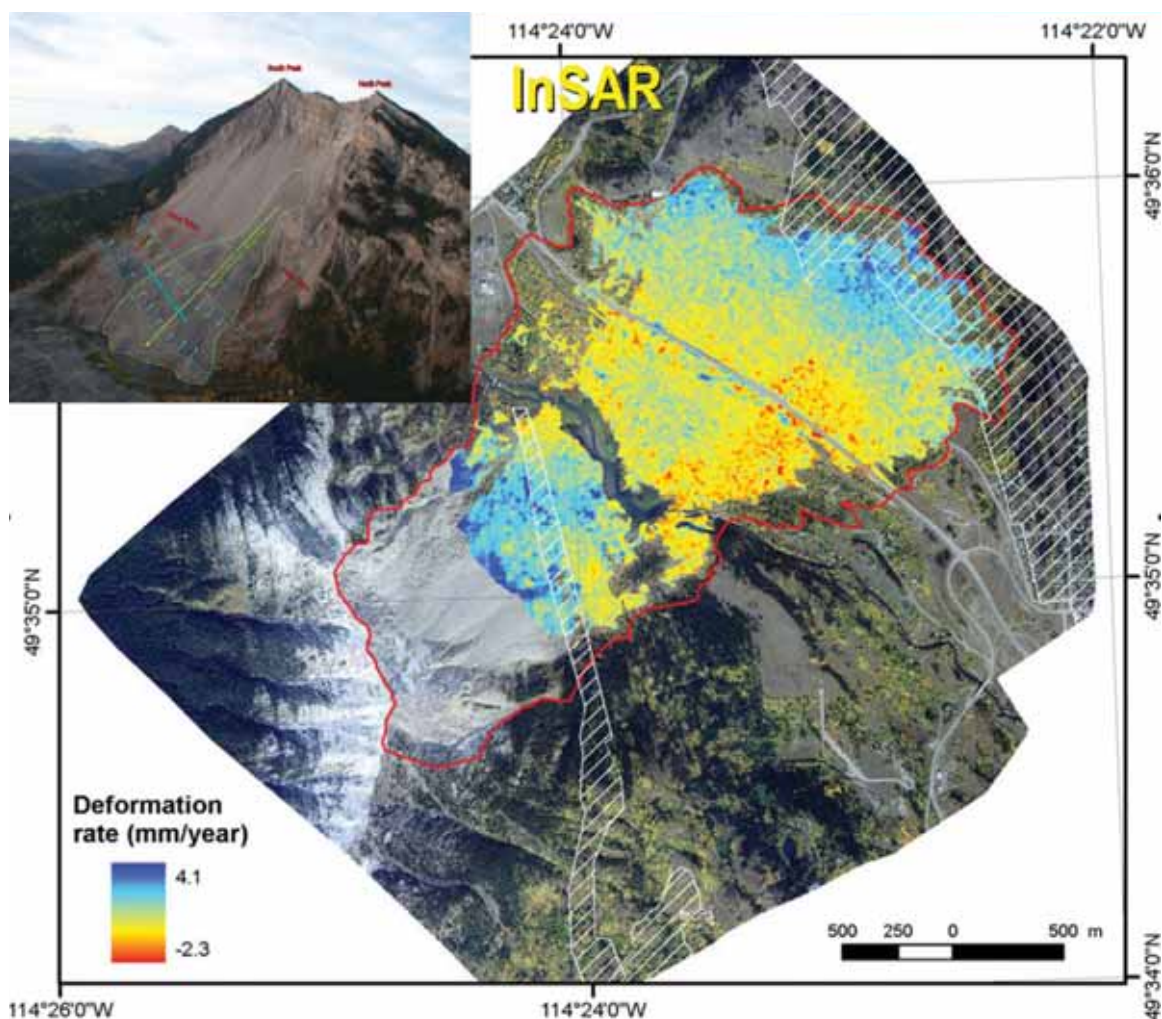
Earth Observation Applications & Utilization Sector

<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

<http://www.earthzine.org/2009/01/13/new-disasters-earth-observation-monitoring-initiative-in-canada-assessment-and-mitigation-of-active-geohazard-sites/>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Landslide Monitoring



[Source: RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2008) -All Rights Reserved]

This information product shows the ground movement, in millimeters per year, and landslides on Turtle Mountain in Alberta, Canada. The product was made using RADARSAT-2 imagery InSAR interferometry techniques. Through the investment of CSA's Government Related Initiatives Program, Natural Resources Canada and the Alberta Geological Survey of Canada are now able to monitor landslide risks along critical energy corridors and pipeline infrastructure.

APPLICATION

5

RAPID MAPPING OF HURRICANE IMPACTS /// STRENGTHENING REGIONAL SECURITY IN THE CARIBBEAN

A. DESCRIPTION

The destructive forces of excessive rain, high wind and pounding waves usually associated with hurricanes and tropical storms can endanger people and wreak havoc along their path (i.e. floods, landslides, infra-structures damages, coastal erosion, etc.). Disaster and emergency management at local, national and international levels require reliable and up-to-date information, and resources to support planning, mitigation, and response activities. The Caribbean Satellite Disaster Pilot (CSDP) is a regional project under GEO Task DI-09-02B. It was established in 2009 in close cooperation with the Committee on Earth Observation Satellites (CEOS) and regional institutions such as the Caribbean Disaster and Emergency Management Agency (CDEMA), the Caribbean Institute for Meteorology and Hydrology and the University of the West Indies (UWI). The emergency management authorities in Barbados, Grenada, Jamaica, Saint Lucia and the Virgin Islands have formally endorsed CSA and NASA disaster preparedness and response activities.

B. SPACE SOLUTION

The objectives of the Caribbean Satellite Disaster Pilot are threefold: (i) to demonstrate the effectiveness of satellite imagery to strengthen regional, national and community level capacity for the mitigation, management and coordinated response to natural hazards; (ii) to identify specific satellite-based products that can be used to support disaster mitigation and response on a regional level; (iii) to identify capacity building activities that will increase the ability of the region to integrate satellite-based information into their disaster management initiatives. The common goal is to take a coordinated, timely and needs-based approach to using detailed Earth Observation data effectively, when preparing for, assessing and mitigating local and regional impacts of natural hazards such as hurricanes. RADARSAT imagery acquired before and after the passage of a hurricane serves to produce rapid change-detection map products detailing extended areas of flooded terrain, landslides areas, coastal erosion impacts, and damage to infrastructure. RADARSAT images are also being provided to scientists to be used as a tool to support rainfall and flood prediction and modeling.

C. GOVERNMENTAL PRIORITIES

- Strengthening Regional Security in the Caribbean
- Supporting Caribbean governments in their response to natural disasters
- Building Resilience of nations and communities to actively deal with disasters
- Helping Canadians in distress
- Ensuring a timely, effective, coherent and appropriate Government of Canada response to supporting relief and recovery requirements, identified on the ground

D. PARTNERING DEPARTMENTS

- Department of Foreign Affairs and International Trade
- Canadian International Development Agency
- National Defence
- Public Safety

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector

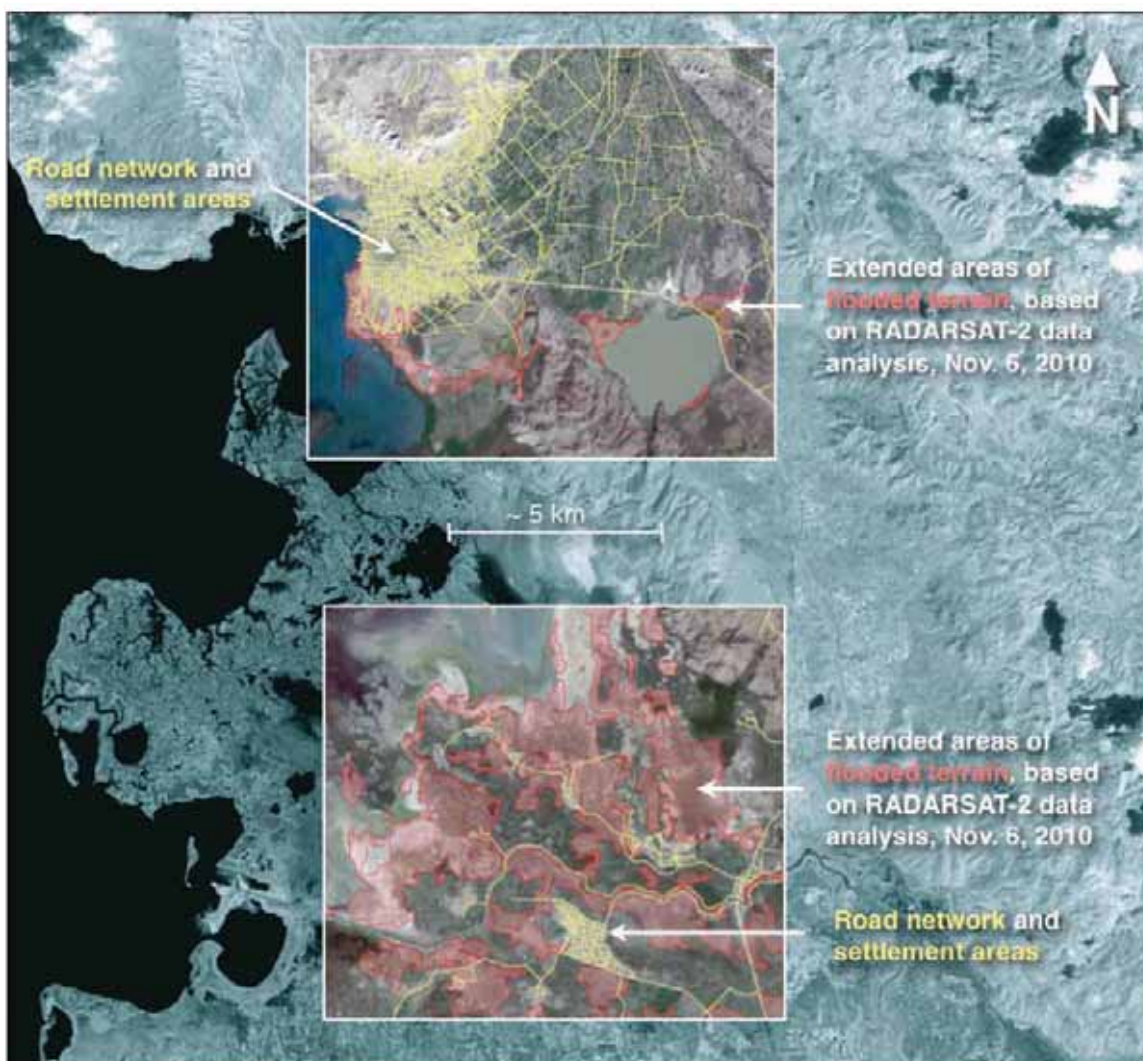
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

From Preparation to Response: Coastal Decision Support during the Caribbean Hurricane Season 2010 with RADARSAT-2:

<http://www.earthzine.org/2010/12/28/from-preparation-to-response-coastal-decision-support-during-the-caribbean-hurricane-season-2010-with-radarsat-2/>

F. EO PRODUCTS EXAMPLES:

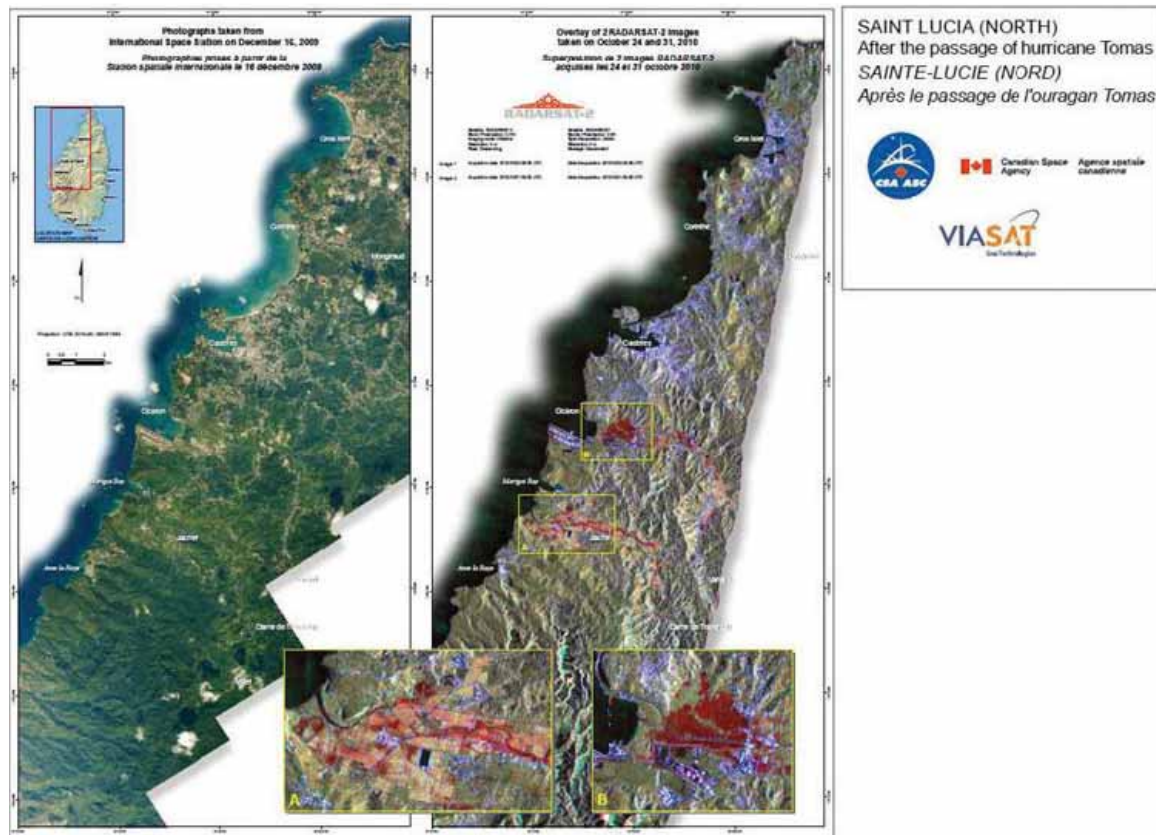
Flooding in Haiti – Hurricane Tomas



[Source: Canadian Space Agency and VIASAT GeoTechnologies, ALI and Landsat data courtesy of NASA, RADARSAT data copyright: MacDonald, Dettwiler and Associates Ltd., 2010]

Detailed composite Earth Observation information product based on satellite data captured by RADARSAT-2, EO-1 ALI and Landsat-TM, indicating extended flooded terrain in the Gonaives region of Haiti, following the passage of Hurricane Tomas on November 5, 2010.

Flooding in St-Lucia – Hurricane Tomas



(Source: Canadian Space Agency and VIASAT GeoTechnologies, RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2010) – All Rights Reserved. RADARSAT is an official mark of the Canadian Space Agency.)

Illustration of a detailed RADARSAT-2 Ultra-fine mode change-detection image information product of data acquired October 24 and October 30 2010 over Saint-Lucia, clearly showing extent of local flooding (marked in red) in low-lying areas following the passage of Hurricane Tomas.

APPLICATION

6

EVALUATING THE RISKS OF MICROBIAL CONTAMINATION IN RECREATIONAL WATERS ///

A. DESCRIPTION

The contamination of water in our lakes and rivers by microbial pathogens flowing from intensive Agricultural production bordering waterways is an emerging public health issue in Canada, particularly in the context of climate change, where more and more people are expected to use these water bodies for swimming and other recreational activities. Exposure to pathogens of fecal origin from the agri-environment can pose a serious health risk. Given that recreational waters (lake and river beaches) may be a source of exposure, effective and rigorous methods must be developed in order to gain a better understanding of the risk of fecal microbial contamination of these waters.

B. SPACE SOLUTION

Under the Canadian Space Agency Government Related Initiatives Program, the Public Health Agency of Canada (PHAC) is conducting a study, using satellite imagery, to improve the monitoring and evaluation of the risks of microbial contamination of recreational waters. The pilot project, which covers selected public beaches in southern Quebec, focuses on evaluating the usefulness of satellite images in identifying and describing the agri-environmental characteristics associated with fecal contamination of beaches, with the ultimate goal of deploying more precise and effective health monitoring efforts over a larger area. By identifying and gaining a better understanding of these territorial characteristics, public health authorities will be able to supplement existing monitoring programs based on water quality indicators and better target beaches at highest risk. Data captured by the European Space Agency's Envisat(MERIS) and Canada's RADARSAT-2 satellites will be used to support this pilot project.

C. GOVERNMENTAL PRIORITIES

- Strengthening Canada's capacity to protect and improve the health of Canadians and help reduce pressures on the health care system
- Strengthen public health capacity by increasing understanding of the determinants of health and common factors that maintain health or lead to disease and injury
- Reduce the risk of contamination by microbial pathogens from the agri-environment
- Improve the monitoring and assessment of contamination risks of recreational waters in Canada
- Prevent and control the spread of infectious diseases
- Improve water quality indicators

D. PARTNERING DEPARTMENT

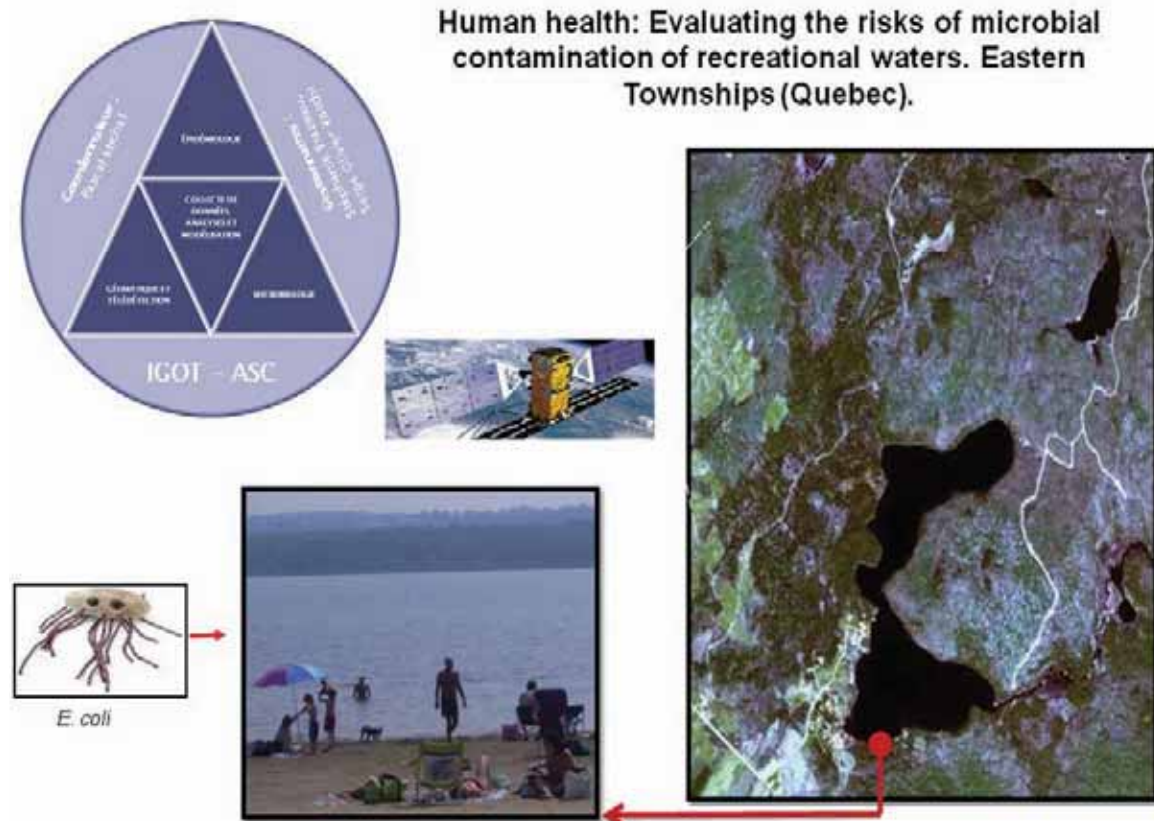
- Public Health Agency Canada

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Water quality



[Source: Public Health Agency of Canada, Canadian Space Agency, 2011]

The Public Health Agency of Canada uses high-resolution optical images such as those produced by the QuickBird satellite which is capable of 60-70 cm resolution in the panchromatic band and 2.4 m to 2.8 m resolution in the multispectral band.

Images produced by the satellite are used to characterize and monitor land use and water quality near shorelines and public beaches. In the above image, dark green = forest; pale green = residential areas; black = drainage systems; purple = deforested areas; and, white lines = roads. RADARSAT-2 satellite images will be used in the future to capture and document these changing conditions.

APPLICATION

7

MONITORING UNSTABLE AREAS ///**A. DESCRIPTION**

Canada's critical infrastructure is vulnerable to disasters, whether natural (e.g., landslides, pandemic, floods, ice storms) or induced by human activity. As the rate and severity of disasters increases, so does the possibility that the disruption of critical infrastructure could result in widespread effects, cascading across borders and sectors, rapidly escalating from local to regional and national levels resulting in social and economic losses. The Mackenzie Valley Pipeline when completed, is estimated to cost \$7 billion. It will traverse a 1,300 km corridor, to deliver natural gas to markets located in southern Canada and United States. Protecting mining infrastructures and preventing or mitigating the impact of disasters (i.e. ground subsidence, triggering of slope failures, etc.) is important to assure the safety of people living and working in these areas and continued economic stability.

B. SPACE SOLUTION

Radarsat Interferometric techniques are used to predict unstable areas, triggered by permafrost melt, along the Mackenzie Valley Pipeline route.

C. GOVERNMENTAL PRIORITIES

- Supporting the sustainable minerals development and use in Canada and around the world
- Assessment of the hazards associated with mining to improve safety
- Promoting innovation and enhancing the competitiveness of Canada's value-added and related product industries
- Assisting Canadian mining firms to use more efficient production techniques, resulting in economic benefits and savings
- Improving health and safety in the mining environment

D. PARTNERING DEPARTMENT

- National Resources Canada (Geological Survey of Canada)

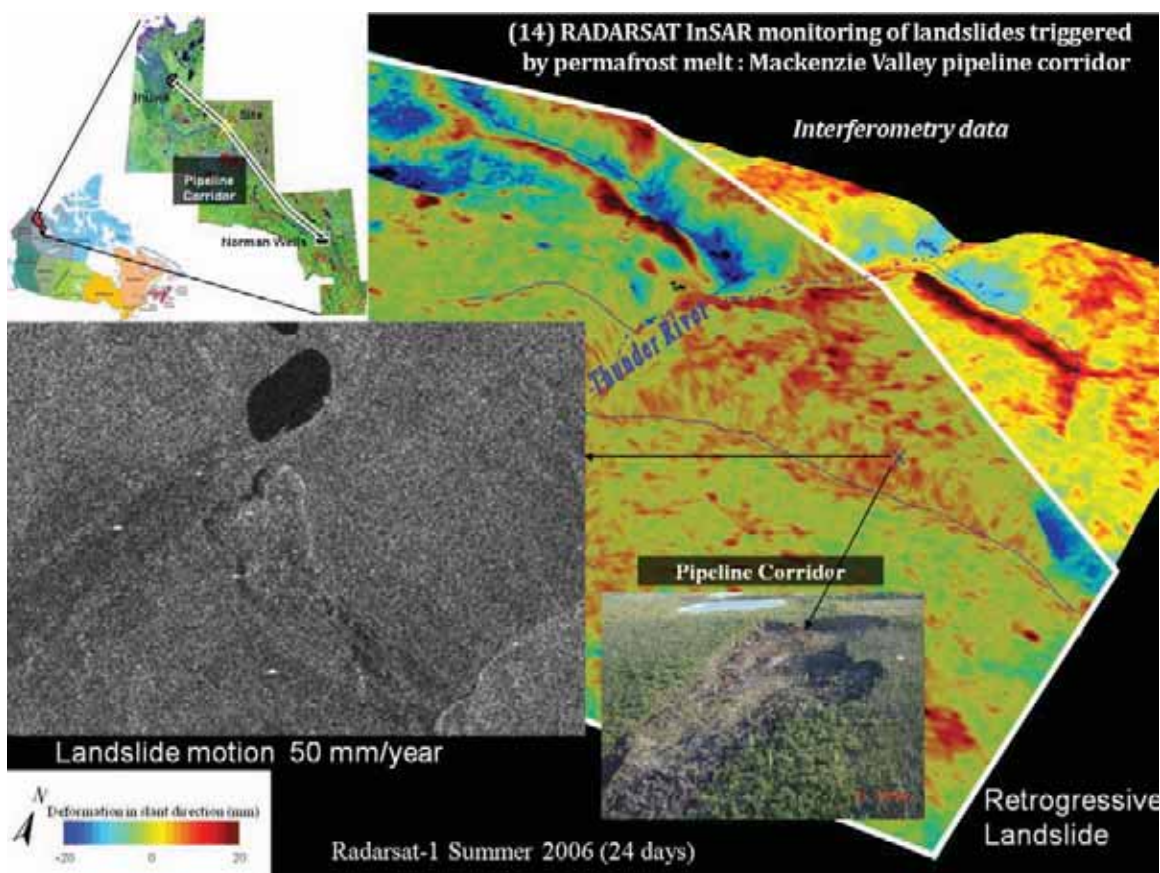
E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

From Earth Observation Benefits to Economy
http://www.asc-csa.gc.ca/eng/programs/grip/archive_090820.asp

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Pipeline Corridor Monitoring



(Source: Natural Resources Canada, Canadian Space Agency, 2010)

This RADARSAT InSAR product shows the monitoring of landslides triggered by permafrost melt in the Mackenzie Valley pipeline corridor (North-West Territories) over a 24 day period in Summer 2006.

Areas in red and blue indicate regions where the ground deformation is very high (± 20 mm). The radar image shows the lake in black and the contour of the landslide in white. The photograph represents the same area as the satellite radar image. The lake is located at the top of the photograph, with the landslide just below.

APPLICATION

8

MONITORING CRYOSPHERE CHANGES ///**A. DESCRIPTION**

Glaciers and permafrost are an important component of the Canadian cryosphere landscape and an integral part of the global climate system. The climate signal represented in permafrost and glacier variations reflect an integrated response to all aspects of the surface climate. Variations in permafrost and glacier conditions can have important implications for natural and human systems including: water/aquatic resources; sea-level rise; terrain hazards; ecosystems; infrastructure; and carbon sources and sinks.

B. SPACE SOLUTION

Since 2000, surface velocity fields have been derived annually over 11 tidewater glaciers using a specialized tracking technique applied to data produced by the Canadian satellite Radarsat-1. Velocity mapping over these target glaciers has continued through to 2010, using data captured by Radarsat-2 since 2009. The changes in glacier flow rates observed over this 10 year period showed their significance in terms of understanding the mechanisms controlling glacier flow and their impact on the state of health of ice caps in the Canadian high Arctic.

C. GOVERNMENTAL PRIORITIES

- Responding to climate-related risks and impacts
- Understanding the global climate system
- Providing Canada with a comprehensive geosciences knowledge base contributing to environmental protection
- Assessing Canadian Water Resources

D. PARTNERING DEPARTMENT

- Natural Resources Canada (Geological Survey of Canada)

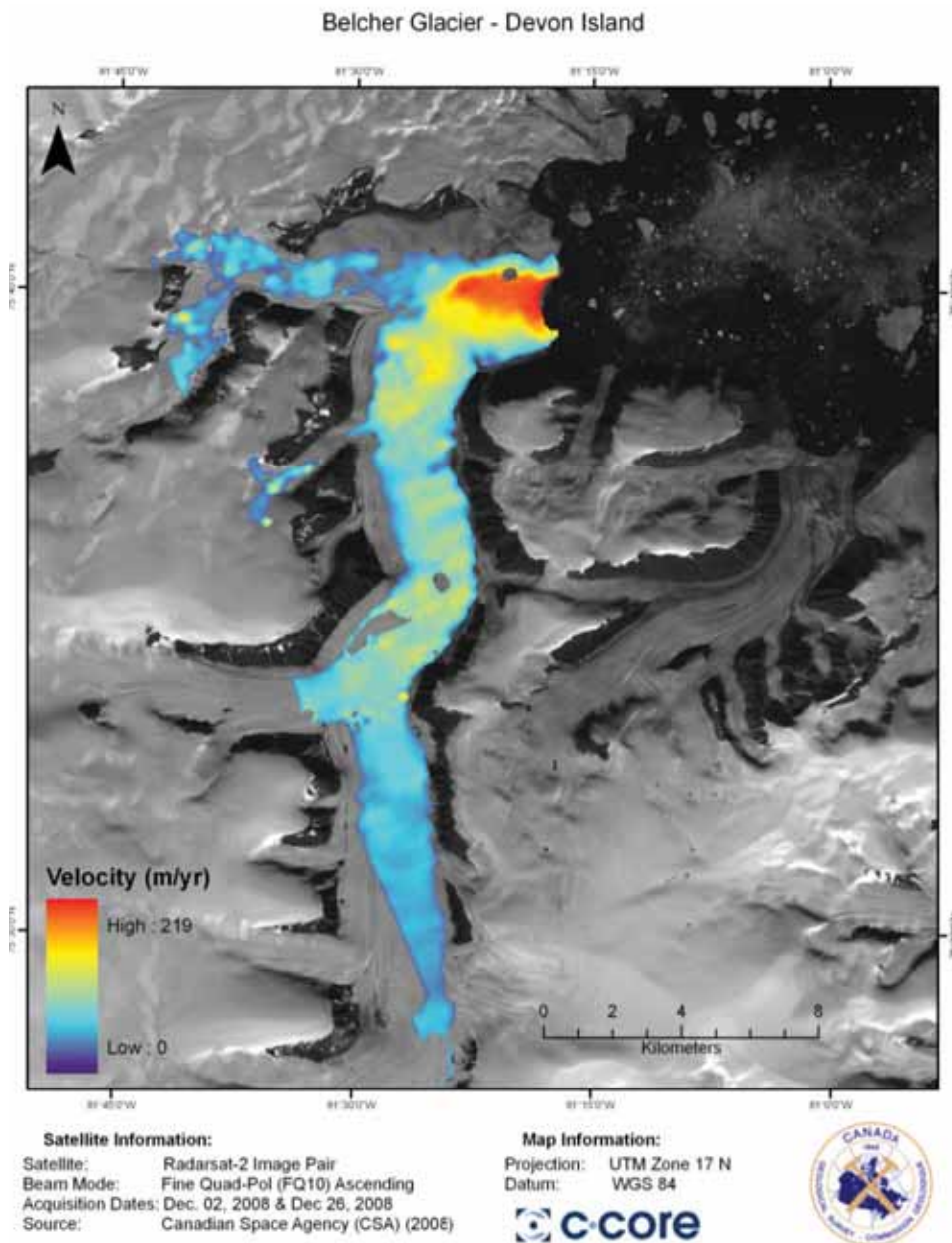
E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector

<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Monitoring Glacier Velocity



Glacier velocity measured at the Belcher Glacier, located on Devon Island, Canada. The results were derived from a pair of RADARSAT-2 Fine beam images captured in December 2008. Areas in red indicate high velocity movement (+100 to 219 meters/year). Those areas coloured in purple and blue indicate low velocity (+0 to 100 meters/years).

STRENGTHENING MARITIME SURVEILLANCE AND SHIP DETECTION ///

A. DESCRIPTION

Worldwide offshore resource-based operations such as fishing, oil and gas exploration and production have intensified over the past few decades. Government and industry require powerful applications to help assess the state of the resources and risks associated with conducting operations in an often harsh ocean environment. The significant level of marine activity in the northern and southern latitudes and the presence of icebergs, pose a hazard to offshore fisheries, hydrocarbon exploration, and shipping. In the offshore oil and gas sector, the cost of building production platforms capable of withstanding undetected and difficult to manage icebergs is a significant economic factor that impacts on the viability of Canada's East Coast oil and gas reserves. Therefore, assuring the consistent and reliable detection of ships and icebergs is extremely important when developing offshore resources in iceberg-infested waters. Even more important, however, is the ability to clearly discriminate ships from icebergs, as misclassification may result in expending and deploying significant resources to confirm initial findings and put in place mitigation measures.

B. SPACE SOLUTION

To monitor the world's oceans, Canada provides highly precise RADARSAT-1 data supporting operational applications such as ship and iceberg detection; oil spill monitoring; wind and surface-wave field estimation; and with Radarsat-2 has greatly improved the quality of images actively supporting iceberg and ship detection, absolutely critical for securing safe navigation in Canada's ice infested waters.

C. GOVERNMENTAL PRIORITIES

- Supporting safe offshore exploration and production
- Supporting safe maritime navigation and transport
- Strengthening maritime surveillance for the security of Canadians

D. PARTNERING DEPARTMENTS

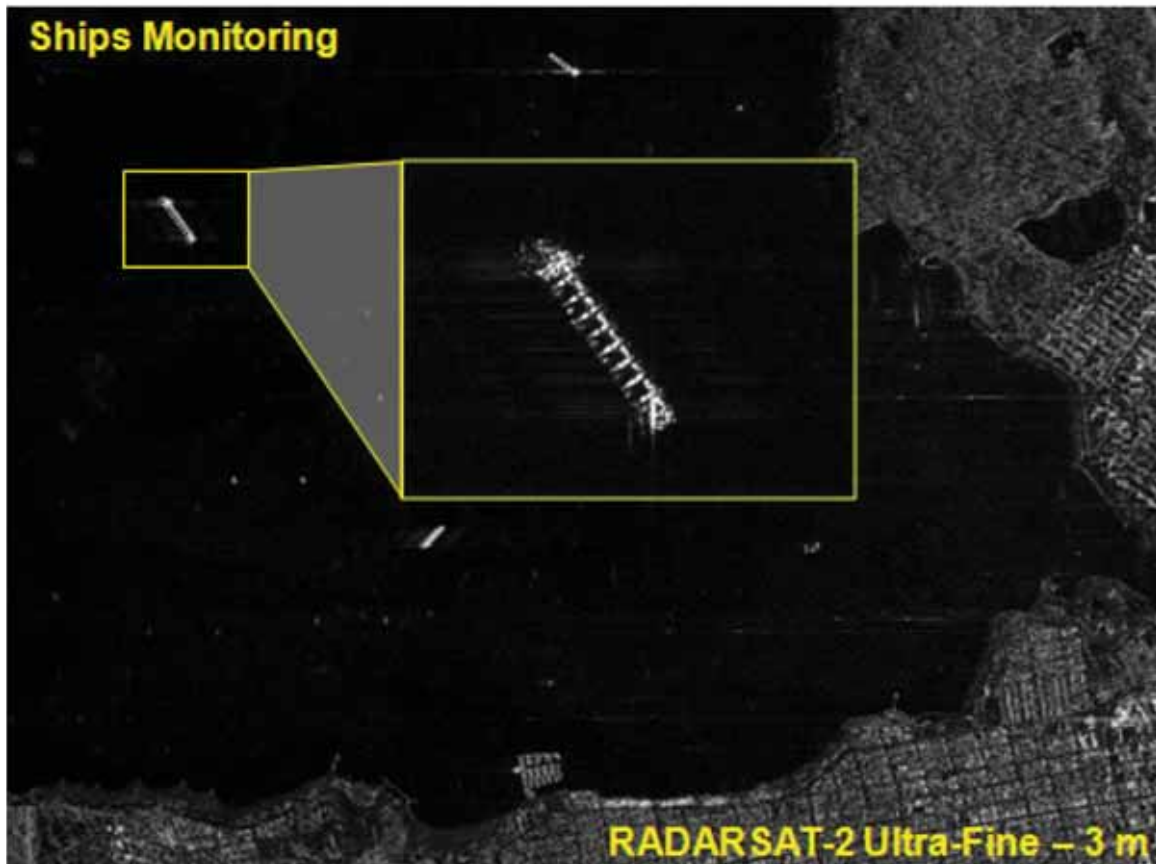
- National Defence
- Department of Fisheries and Oceans
- Environment Canada
- Canadian Ice Service
- Transport Canada

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Ship Detection



[Source: RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2010) – All Rights Reserved. RADARSAT is an official mark of the Canadian Space Agency.]

Ship in the harbor of Vancouver, British Columbia captured using the Radarsat-2 ultra-fine mode. The enlarged frame shows more details of the ship allowing the identification of the type of ship, such as the cargo vessel identified above.

WATER PROSPECTING AND RESOURCE MANAGEMENT ///

A. DESCRIPTION

Canada possesses vast fresh water reserves. Groundwater resources provide drinking water for one third of all Canadians, 80% of whom live in rural areas. Protecting these clean water supplies is a national priority. Canada is a world leader in the development of new tools used to measure the availability of resources and still others, that contribute to improving our management of these resources.. As the global problem of water resource management is becoming increasingly important, applications and tools that could precisely identify aquifer locations, as well as, their physical and hydraulic qualities will be in great demand.

B. SPACE SOLUTION

The synthetic aperture radar sensor deployed on Canada's RADARSAT satellites is capable of acquiring information on the properties related to soil moisture and soil permeability, including the detection of recharge areas that replenish bodies of water and sensitive areas that may be subject to contamination. Groundwater is not directly detectable from space, but by observing the Earth, satellites gather information on the surface parameters affecting groundwater. The groundwater recharge of regional aquifers, a key element of a groundwater mapping, generally takes into account climatic data, the physical properties of soil, vegetation growth and density, as well as surface drainage properties. Knowledge of land cover and land use and therefore soil properties, information derived from Earth Observation, are essential information for estimating water-balance parameters.

Natural Resources Canada and the Canadian Space Agency have joined forces through the Groundwater Geoscience Program (GGP) to develop satellite Earth Observation applications in current groundwater mapping efforts. The GGP focuses on (1) mapping and assessing several key aquifers in Canada, (2) establishing a national perspective of groundwater resources in Canada, and (3) making the data available through the Groundwater Information Network.

C. GOVERNMENTAL PRIORITY

- Protection of supplies of clean water

D. PARTNERING DEPARTMENT

- Natural Resources Canada (Geological Survey of Canada)

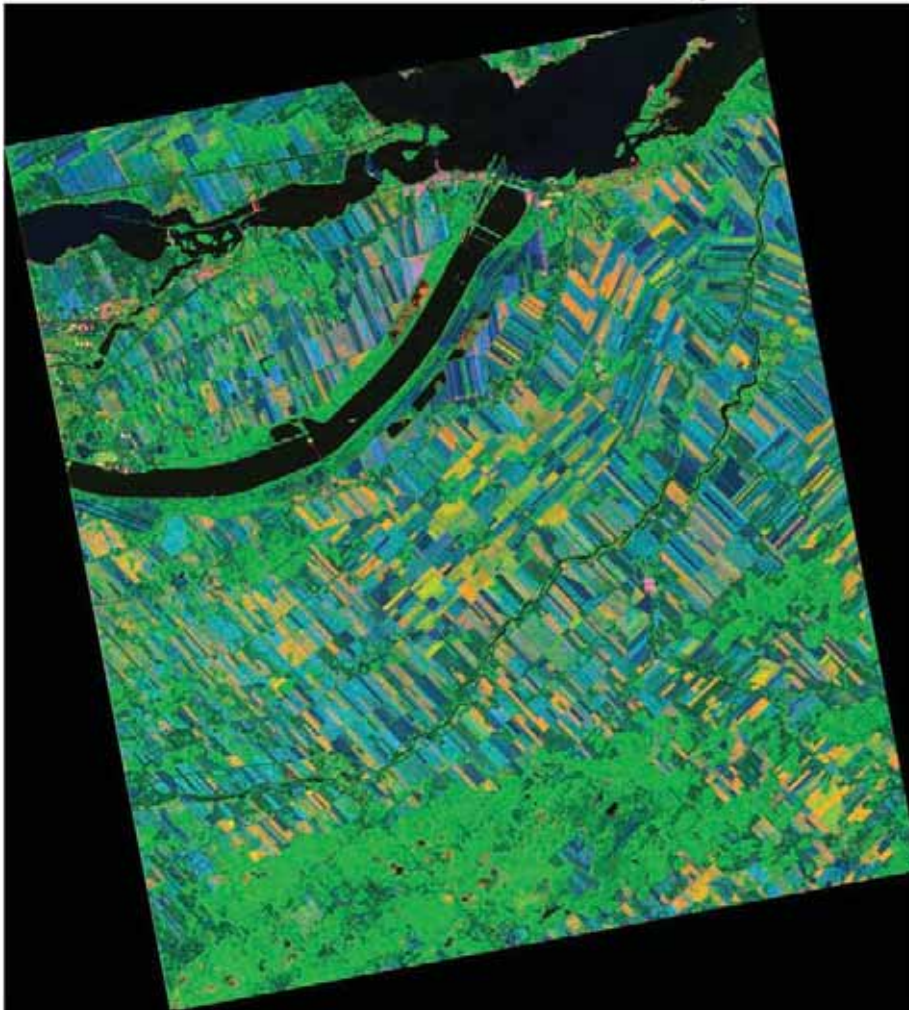
E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector

<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Soil Moisture and Permeability



[Source: RADARSAT-2 Data and Product © MacDonald, Dettwiler and Associates Ltd. (2008) – All Rights Reserved.]

Châteauguay River Basin Watershed, South-West of Montreal (Canada)

The region is characterized by an agricultural landscape with small woodland islands bordered on the north by the St. Lawrence River. The image depicts in different colors agricultural lands associated with soil moisture, tillage practices and the density of vegetation.

The blue to turquoise color indicates bare soil and is influenced by soil moisture. The green color indicates vegetation, while the yellow/orange color indicates tillage practices reflected from crops. Analysis and interpretation of these images requires the knowledge that farmers often harvest or cut the plants at the level of the soil, which generates a double bounce of the radar satellite signal.

SPACE: SUPPORTING ECOSYSTEM MANAGEMENT ///

A. DESCRIPTION

Canada's oceans cover a surface area of 7.1 million km² approximately 70% of Canada's landmass. The Government of Canada is using a modern and coordinated approach to manage the impact of human activities on Canada's oceans in a sustainable manner, creating a balance between protecting marine ecosystems and maintaining a prosperous economy. The mission of the Department of Fisheries and Oceans (DFO) is to deliver the following outcomes to Canadians: 1) Economically Prosperous Maritime Sectors and Fisheries; 2) Sustainable Aquatic Ecosystems; and 3) Safe and Secure Waters. The 1997 Oceans Act entrenched an ecosystem approach to oceans management, based on the principles of integrated resource management, sustainable development, and precaution. Through a partnership with the Canadian Space Agency scientists at DFO are exploring new ways of exploiting Earth Observation data, while developing systems that enhance the quality of information and increase knowledge in support of their mandate.

B. SPACE SOLUTION

Through the CSA's Government Related Initiatives Program, DFO has developed a set of EO-based tools that are used to support ecosystem-based aquatic management. These tools will serve as the foundation for the future development of additional tools as our understanding of aquatic ecosystems advances. The collaboration of DFO and CSA through projects is leading to the development of protocols and methodologies for the use of EO data in fisheries research and management, and at the same time is building capacity within DFO at the science and the operational level, and helping develop an increased demand for additional EO information products.

C. GOVERNMENTAL PRIORITIES

- Ensuring economically prosperous maritime sectors and fisheries
- Ensuring sustainable Aquatic Ecosystems
- Ensuring safe and secure waters
- Safeguarding ocean ecosystems

D. PARTNERING DEPARTMENT

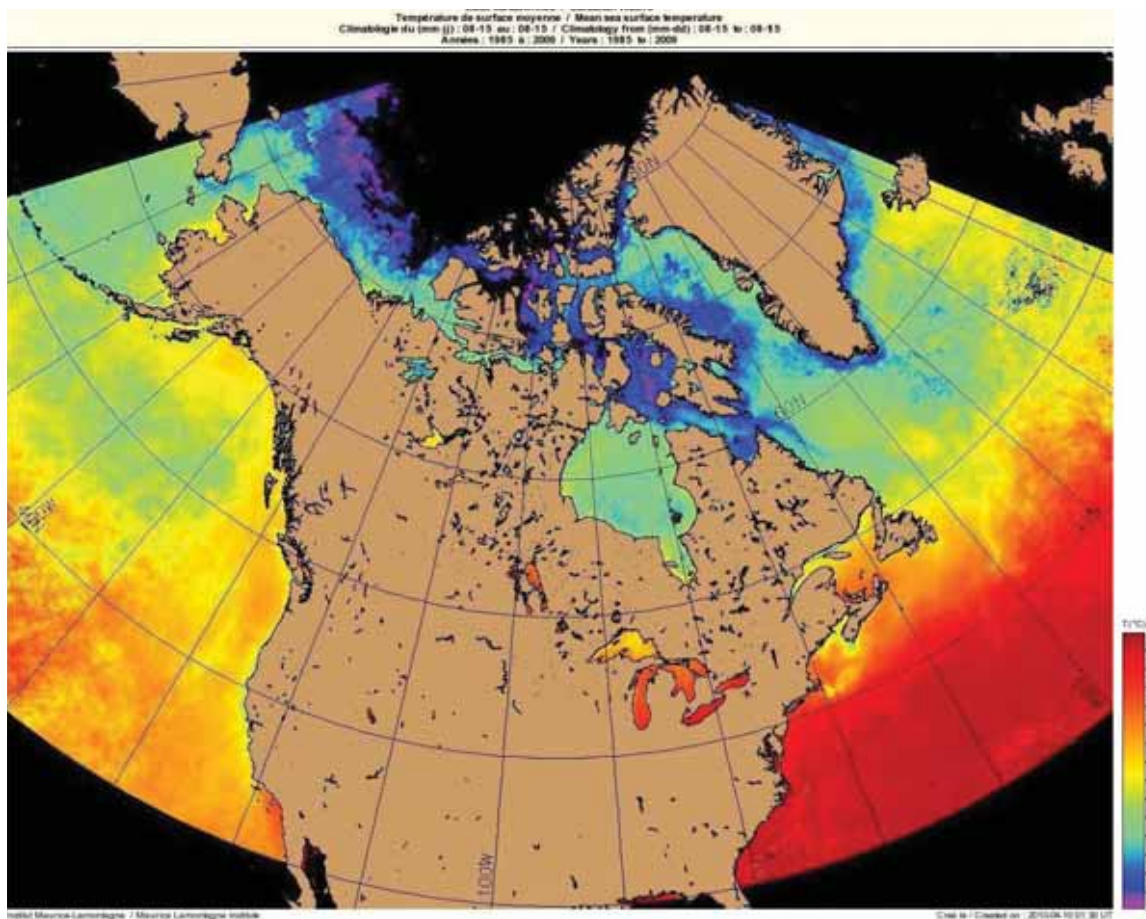
- Department of Fisheries and Oceans

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Sea Surface Temperature – MODIS



Summer sea surface temperature climatology of Canadian waters (August 15, 1985-2009)

This Earth Observation information product was derived from MODIS satellite data and shows the different temperatures of the sea surface of Canadian waters. Red indicating the warmest areas, and violet the coldest.

ENSURING SAFE NAVIGATION IN CANADA'S ICY WATERS ///

A. DESCRIPTION

Environment Canada's Canadian Ice Service is responsible for the daily monitoring of Canadian coastal waters for the presence and conditions of lake ice, sea ice and icebergs. The provision of reliable and timely ice information to marine clients promotes safe and efficient maritime operations and protects "Canada's Exclusive 200 mile Economic Zone". The Canadian Ice Service has been an operational user of RADARSAT-1 data since the launch of the satellite in 1995. In fall of 2008, their operations began to use the more highly precise data captured by the recently launched RADARSAT-2.

B. SPACE SOLUTION

The primary mandate of Environment Canada is to support safe, efficient marine shipping in ice-covered waters. Initially Radarsat-1 and now RADARSAT-2, capable of operation day-and-night in all weather conditions, are the prime Earth Observation satellites serving the Canadian Ice Service. The Ice monitoring program clearly focuses on the changing conditions that may threaten the safety of vessels navigating our ice infested waters. Therefore it is important to obtain, process and analyse the Earth Observation data in less than four hours, if that information is to meet the demanding needs of vessels navigating in a hostile and rapidly changing environment. As an example, over the past year, 7,000 near real time RADARSAT-2 images have been received and analysed by Canadian Ice Service image analysts.

C. GOVERNMENTAL PRIORITIES

- Promoting safe and efficient maritime operations
- Providing accurate and timely information about ice conditions in Canada's navigable waters
- Ensuring the safety of Canadian, their property and their environment by warning them of hazardous ice conditions
- Providing present and future generations of Canadians with sufficient knowledge about their ice environment in order to support sound environment policies

D. PARTNERING DEPARTMENTS

- Environment Canada (Canadian Ice Service)
- Canadian Coast Guard
- National Defence
- Transport Canada
- Department of Fisheries and Oceans

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE

Sea Ice Conditions



This information product shows icebergs and ice motion traces around the coast of Baffin Island in the Canadian Arctic. The image was captured by RADARSAT-2 using its Standard Quad Polarization mode in 25 metre resolution. When icebergs are embedded in pack ice, they can be detected by the trails of broken ice left by the inertial or tidal motion of the pack ice which is more fully examined in the inset in red located in the right corner.

APPLICATION

13

MONITORING HARMFUL ALGAE IN CANADIAN WATERS ///**A. DESCRIPTION**

A clean and balanced environment contributes to our quality of life and standard of living. As an example, clean water is both a critical and absolutely essential resource. The excessive growth of algae can be detrimental to the economic and environmental value of Canadian inland waters and can pose potential health risks when present in sufficient concentrations. The Government of Canada has developed a comprehensive strategy to secure clean water for all Canadians and over the past few years a number of concrete and measurable actions have been taken to implement this approach.

B. SPACE SOLUTION

In partnership with the the CSA's Government Related Initiatives Program, Environment Canada's National Water Research Institute is using satellite Earth Observation data, including that produced by MERIS, an imaging spectrometer aboard Envisat. The Earth Observation data generated in near-real time, helps produce water quality products that may provide cost-effective support for water quality monitoring programs within the Great Lakes and St. Lawrence watersheds. Environment Canada is using Earth Observation data, especially MERIS, to (1) construct time-series of satellite-derived water quality products covering the lower Great Lakes and both the St Lawrence River and associated fluvial lakes, (2) determine the optical cross-section spectra appropriate to these inland waters with a particular emphasis on harmful algal blooms, (3) modify existing or develop new optical models/algorithms for use with MERIS sensor aquatic colour data. The technology and science are now in place within National Water Research Institute to acquire and process aquatic colour remote sensing data over Canadian inland waters in near-real-time, producing daily snapshots of inland water conditions on a routine, fully automated basis. These products provide valuable synoptic coverage of Canada's inland waters that has the potential to enhance the current capabilities of ground-based water quality monitoring networks.

C. GOVERNMENTAL PRIORITIES

- Ensuring a Cleaner, Healthier Environment
- Reporting on the status, trends and surveillance of the freshwater quality monitoring
- Preserving and protecting our major watersheds for future generations
- Monitoring water quality
- Generating and sharing scientific knowledge needed to resolve environmental issues of regional, national or international significance to Canada
- Sustaining our natural resources and freshwaters ecosystems

D. PARTNERING DEPARTMENT

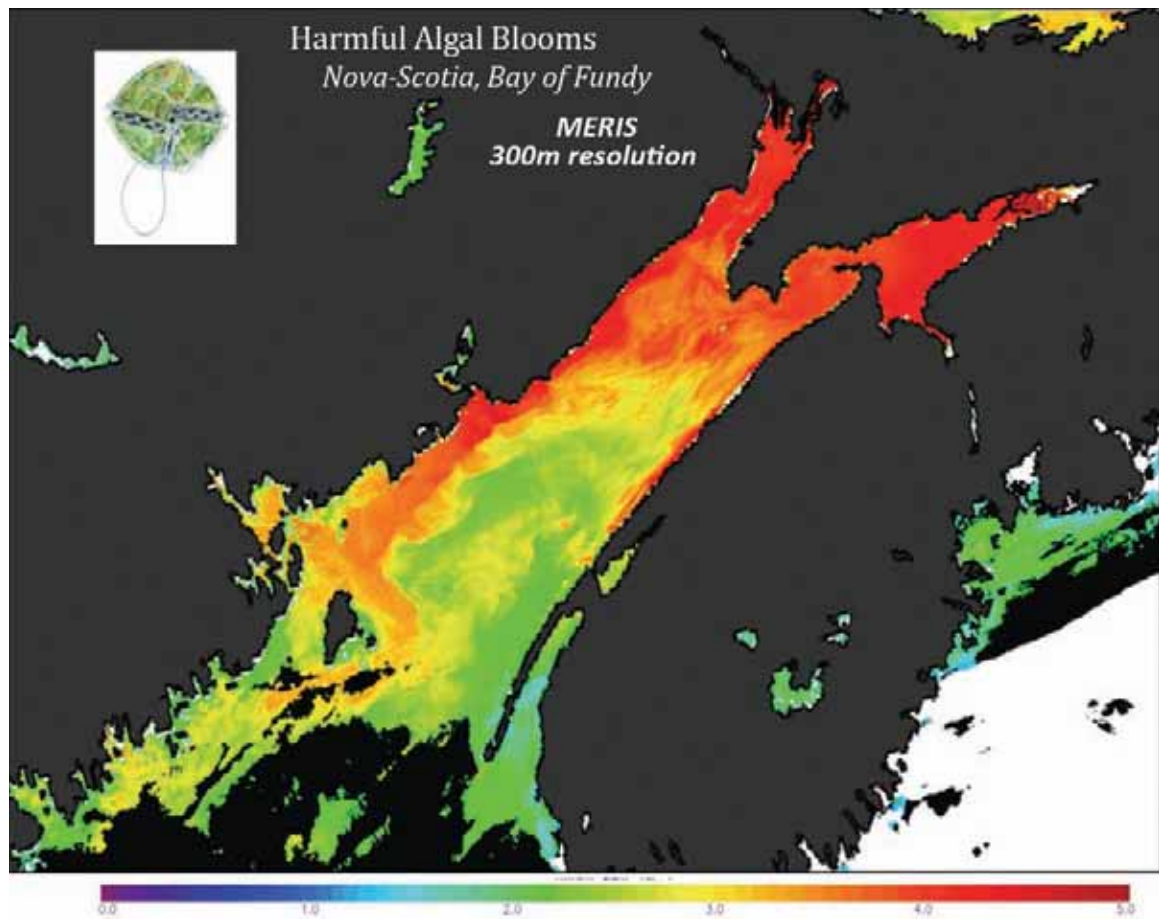
- Environment Canada (National Water Research Institute)

E. FOR MORE INFORMATION

www.ec.gc.ca/inre-nwri/Default.asp?lang=En&n=37A22BD5-1

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Water Quality



[Source: Environment Canada, 2011]

This information product was produced by the Department of Fisheries and Oceans and Environment Canada using images captured by the MERIS instrument aboard the European Space Agency's ENVISAT at 300 metres resolution. The image shows an intense algal bloom in the Bay of Fundy, Nova Scotia, Canada. The color scale depicts a high density of chlorophyll in red with lower densities in blue.

CANADA'S COASTAL ZONES /// ENHANCING MARINE WIND AND WEATHER FORECASTS

A. DESCRIPTION

Understanding and predicting weather, and particularly winds, in Canada's coastal zones is critical to ensuring economic wellbeing as well as safety and security of Canadians. Economic activity is increasing on both the Pacific and Atlantic coasts, and on the Great Lakes. Furthermore it is expected that growth in shipping, commerce and natural resources exploration will occur in the Arctic as ice continues to recede due to climate change. Timely information on winds over sea, at scales that only Synthetic Aperture Radar satellites can provide, is key to the provision of improved marine forecasts as well as forecasts for coastal areas. The benefits of these improved weather forecasts accrue to several sectors, including shipping, fishing, energy, and recreation, all of which are extremely susceptible to changing weather conditions on local scales.

B. SPACE SOLUTION

Through the Canadian Space Agency's Government Related Initiatives Program, Environment Canada is developing a project entitled "The National SAR Wind Project for High Resolution Marine Wind". This project uses the microwave based Synthetic Aperture Radar satellite to conduct space-based monitoring. RADARSAT-1, RADARSAT-2 and the European Space Agency's ENVISAT ASAR instrument produce precision data that is improving wind analysis and short-range prediction over large marine areas, and especially in the coastal zones. Environment Canada is implementing a national quasi-operational prototype of the Synthetic Aperture Radar Wind system which currently integrates nearly 1600 images per month. It is expected that this application will become fully operational within the next 2 years. Environment Canada is leading this initiative in partnership with the National Laboratories of its Meteorological Service of Canada, the Storm Prediction Centre, the Canadian Meteorological Centre, the Department of Fisheries and Oceans, the Department of National Defence and the U.S. National Oceanic and Atmospheric Administration.

C. GOVERNMENTAL PRIORITIES

- Supporting safe maritime transport
- Strengthening maritime surveillance for the security of Canadians
- Strengthening collaboration among departments and with counterparts in the United States

D. PARTNERING DEPARTMENTS

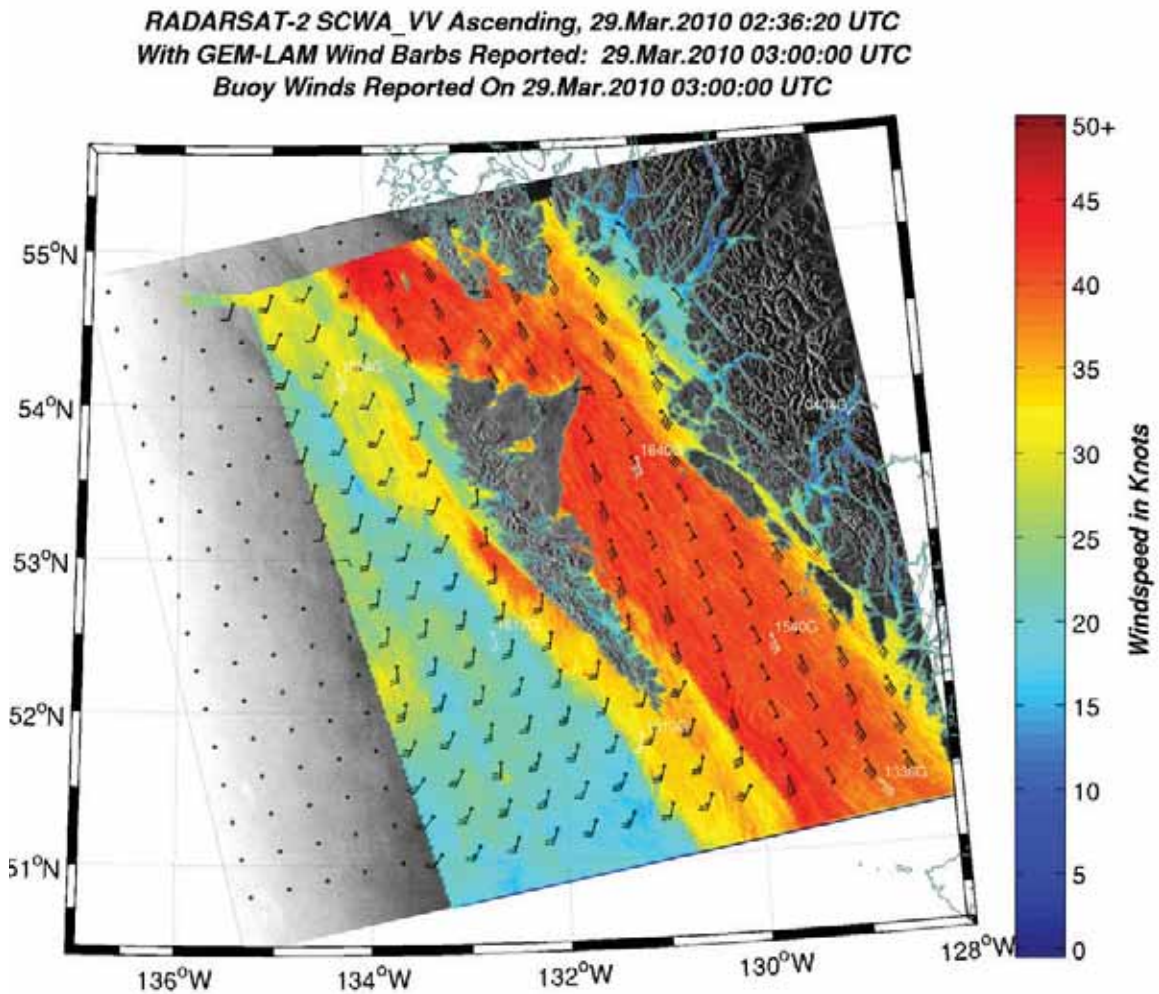
- Environment Canada
- National Defence
- Department of Fisheries and Oceans
- Defence Research and Development Canada
- National Oceanic and Atmospheric Administration (U.S.)

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Detection of Marine Winds



(Source: RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2010) -All Rights Reserved)

This information product produced from Synthetic Aperture Radar data captured by RADARSAT-2 is providing new insights to meteorologists. Here we clearly see colored in orange, the strength and extent of a barrier jet along the coast of the Queen Charlotte Islands in British Columbia.

APPLICATION

15

SUPPORTING SUSTAINABLE AGRICULTURE ///**A. DESCRIPTION**

Food supplies depend on trends in the natural environment, including weather and climate, freshwater supplies, soil moisture and other variables. At the same time, agriculture has a major impact on the environment. Unless they are sustainably managed, farms and pastures are subject to erosion, desertification, chemical pollution and water shortages. These risks need to be actively monitored and managed.

B. SPACE SOLUTION

Through the Canadian Space Agency's Government Related Initiatives Program, Agriculture and Agri-Food Canada is developing new soil, water and land management tools at the regional and national scales. These applications are helping the Government of Canada, farmers and policymakers to maximize productivity and food security, while preserving ecosystems and biodiversity. Agriculture and Agri-Food Canada is supporting the sustainable management of agriculture by using Earth Observation data, such as that provided by RADARSAT-2, to both simulate and predict agricultural trends. Earth Observation related activities at Agriculture and Agri-Food Canada include mapping the changing distribution of croplands, advancing the accuracy of measurements of biomass (the total amount of living material in a given habitat or population), improving forecasts of shortfalls in crop production and food supplies, and improving the reporting of agricultural statistics. Earth Observation monitoring also improves the ability to monitor soil moisture, map soil erosion and drainage systems, measure the extent and productivity of grasslands and transgenic fields, while contributing to precision farming (i.e. nitrogen watch) throughout the growing and non-growing season.

C. GOVERNMENTAL PRIORITIES

- Implementing sustainable agricultural management practices assuring the preservation of soil, land and water resources
- Increasing agricultural profitability and sustainability through innovation
- Supporting Government programs that help manage and reduce agricultural risks
- Achieve an environmentally sustainable agriculture, agri-food and agri-based products sector
- Contributing to the environmental, health and food security of Canadians
- Enhancing ability of agriculture, agri-food and agri-based products industries to compete in domestic and international markets, deriving economic returns for the sector and the Canadian economy as a whole

D. PARTNERING DEPARTMENT

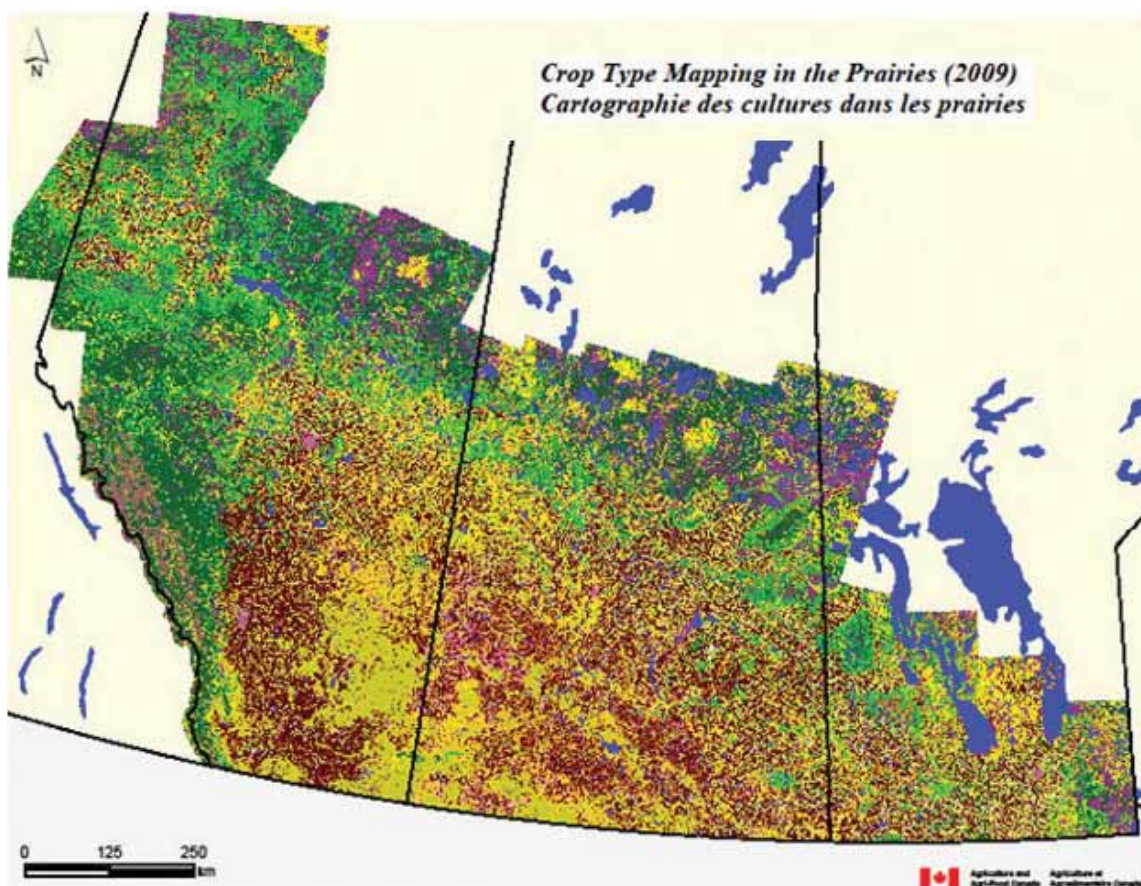
- Agriculture and Agri-Food Canada

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Crop Monitoring



This information product is an extract of the Agriculture and Agri-Food Canada national crop inventory (i.e. crop type mapping) produced using data from a variety of Earth Observation satellites: SPOT, Landsat and Radarsat. Water bodies, shrublands, wetlands, grasslands, canola fields and other crop types are classified and derived from satellite data and appears in different colours on the map product. It should be noted that the colour legend contains a number of colour classes (+20) on a map of this scale. More detailed information is available on request for either Agriculture and Agri-Food Canada or the Canadian Space Agency.

Detailed crop type identification relies on image data acquired during key crop phenological stages in order to capture the unique temporal signature of individual crop types. Optical data such as Landsat and SPOT can provide valuable information for crop classification, however, cloud cover is a reoccurring obstacle to the application of optical data, hindering mapping and monitoring at regional and national scales. Consequently, the integration of radar-based data imaging with optical Earth Observation data is essential for operational monitoring over many areas. The integration of radar and optical data resulted in a synergistic effect, producing an increase in classification accuracies.

MONITORING ECOLOGICAL INTEGRITY OF ARCTIC NATIONAL PARKS ///**A. DESCRIPTION**

National parks are among Canada's and the world's natural jewels. They represent a wide range of protected eco-systems spanning the vast expanse of our nation. Canada's natural environment – is both a compelling force which has shaped not only the geography of this country, but also bears witness to the course of our history and the experiences of the people who founded this nation, who continue to live and work here and still others who travel to take in all its natural beauty. The Parks Canada Agency is working to maintain or restore the ecological integrity of national parks. This means keeping ecosystems healthy and vibrant, in a state where ecosystem biodiversity, structures, functions and broad access by the public both interact and flourish.

B. SPACE SOLUTION

Through the Canadian Space Agency Government Related Initiative Program, the Parks Canada Agency will develop an operational satellite-based system that will enhance the monitoring and detection of changes occurring within Parks located in the North. The monitoring of the land management and resources of our national parks, many of them in remote locations takes full advantage of the unique vantage point of space-based Earth Observation. Canada's northern National Parks encompass an area of 238,800 km², representing 85% of the area of all National Parks, and make a tangible contribution to the sustainable use of Canada's natural resources and to Canada's sovereignty in the Arctic. The overall objective of the project is to develop an operational Parks Canada capability applying the use of space-derived data from a number of satellites including RADARSAT-2, ENVISAT, and SPOT, among others, to enhance its mandate for monitoring and reporting on the management of the Park System in the North. The ParkSPACE project is designed to spearhead the use of developed and tested products in the State of the Park Report for northern parks, and will include the generation of operational monitoring protocols for these parks.

C. GOVERNMENTAL PRIORITIES

- Monitoring ecological integrity within Northern National Parks
- Showcase the richness of Canada's heritage and thereby make a tangible contribution to sustainable use of Canada's natural resources and to Canada's sovereignty in the Arctic
- Providing greater awareness of the value of Canada's National Parks
- Increasing internal capacity within Parks Canada at the science and operational levels

D. PARTNERING DEPARTMENTS

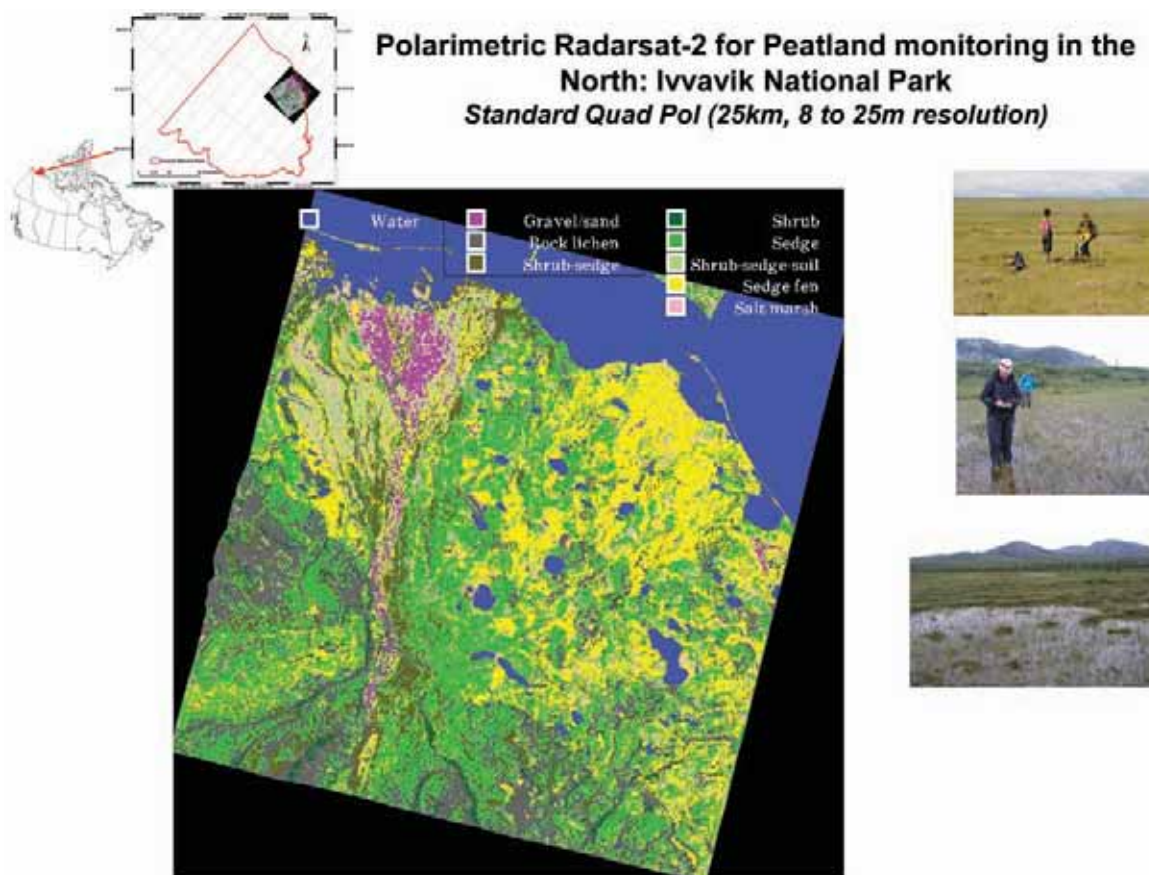
- Parks Canada
- Natural Resources Canada (Canada Remote Sensing Center)

E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector
<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE:

Wetland Mapping



(Source: Natural Resources Canada, 2010)

This information product is a northern wetland classification (Ivvavik National Park) generated from RADARSAT-2 standard quad pol (25 km, 8 to 25 m of resolution) images combined with local topography. The wetlands classes are described in the legend in the top right (i.e. water, shrubs, salt marsh, lichens, fens, gravel sand, etc.).

The two photos above right show field work being conducted in collaboration with Parks Canada, while the bottom photo shows characteristics of local wetlands: strings, pools and fen.

APPLICATION

17

IMPROVING WILDLIFE MANAGEMENT AND ENFORCEMENT ///**A. DESCRIPTION**

Wildlife habitats are under increasing pressure and monitoring and law enforcement methods must adapt to these changes even in the most isolated places. Canada is using space assets to actively monitor distant and inaccessible areas.

B. SPACE SOLUTION

Satellites, such as Canada's RADARSAT-2, function day and night in all weather conditions. They are ideally suited for repetitive imaging to help monitor and track change detection. Information collected from space supports reliable and consistent monitoring across the nation, from the crowded southern border to the most far-flung iceberg in the north. Satellite images, when combined with other digital data can be used to create dynamic maps, images and charts, which can be used in research, or to guide wildlife management and enforcement planning. As an example, the *Space for Habitat* project partners are demonstrating how satellite information can be combined with air-and-land-based information to make better land management decisions. This ability to obtain and evaluate information about species and habitat location, is a major advantage, especially for Canada, the second largest country in the world with large tracts of wilderness that cannot be regularly and completely surveyed on the ground. The *Space for Habitat* project will not only provide greater understanding of wildlife habitat quality and availability, but will also improve the ability to enforce wildlife regulations and influence the drafting of legislation intended to protect wildlife and habitat.

C. GOVERNMENTAL PRIORITIES

- Improving wildlife and ecosystem management and enforcement
- Protecting and monitoring natural landscapes

D. PARTNERING DEPARTMENT

- Environment Canada

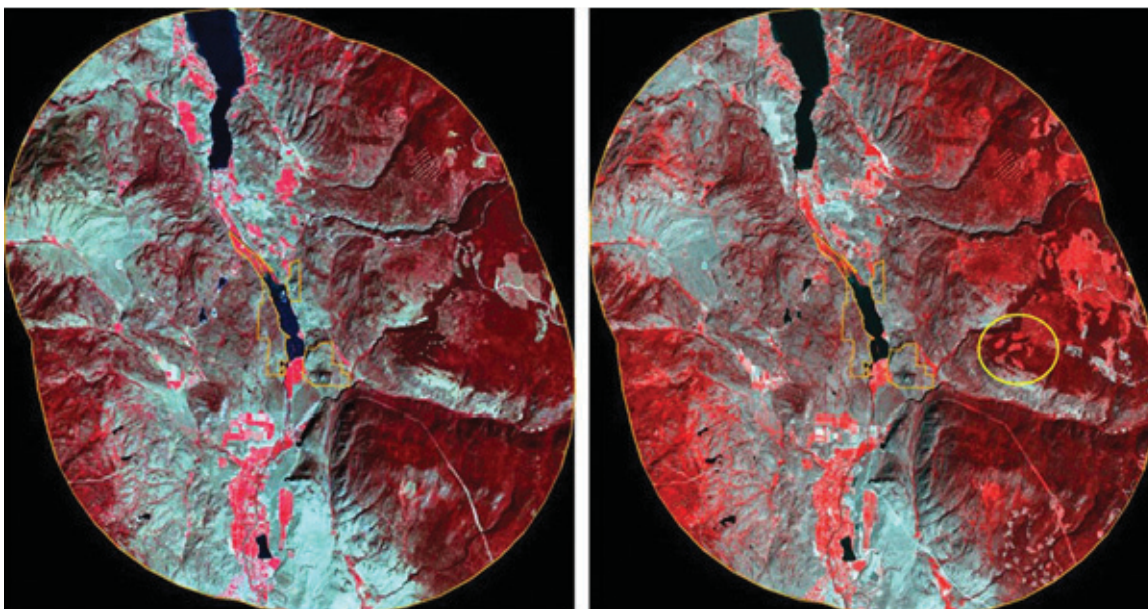
E. FOR MORE INFORMATION

Earth Observation Applications & Utilization Sector

<http://www.asc-csa.gc.ca/eng/observation/applications.asp>

F. EARTH OBSERVATION PRODUCT EXAMPLE

Wildlife Change Detection



[Source: Environment Canada, 2010]

The Vaseux-Bighorn National Wildlife Area in British Columbia, habitat for many rare species, is affected by activities in the highly populated south Okanagan Valley.

The yellow circle in this satellite image indicates changes that have occurred due to forestry activities. Remote sensing imagery is supporting Environment Canada in their efforts to monitor changes (before and after images) occurring in habitats zones and project the impact on wildlife species at risk.

**FOR MORE INFORMATION
ON THE FOLLOWING EARTH
OBSERVATION PROGRAMS OF
THE CANADIAN SPACE AGENCY ///**

- Earth Observation Applications & Utilizations (EOAU)
- Earth Observation Application Development Program (EOADP)
- Government Related Initiatives Program (GRIP)
- Science and Operational Applications Research for RADARSAT-2 (SOAR)
- RADARSAT-1 Data for Research use (DRU)

WWW.ASC-CSA.GC.CA/ENG/OBSERVATION/APPLICATIONS.ASP

