

# RADARSAT

## Mision Update & Overview


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Mission Manager



Canadian Space Agency / Agence spatiale canadienne





 World Conference Center Bonn

5m Compact Polarimetry March 26 2022  
RADARSAT Constellation Mission Imagery © Government of Canada  
(2022) RADARSAT is an official mark of the Canadian Space Agency

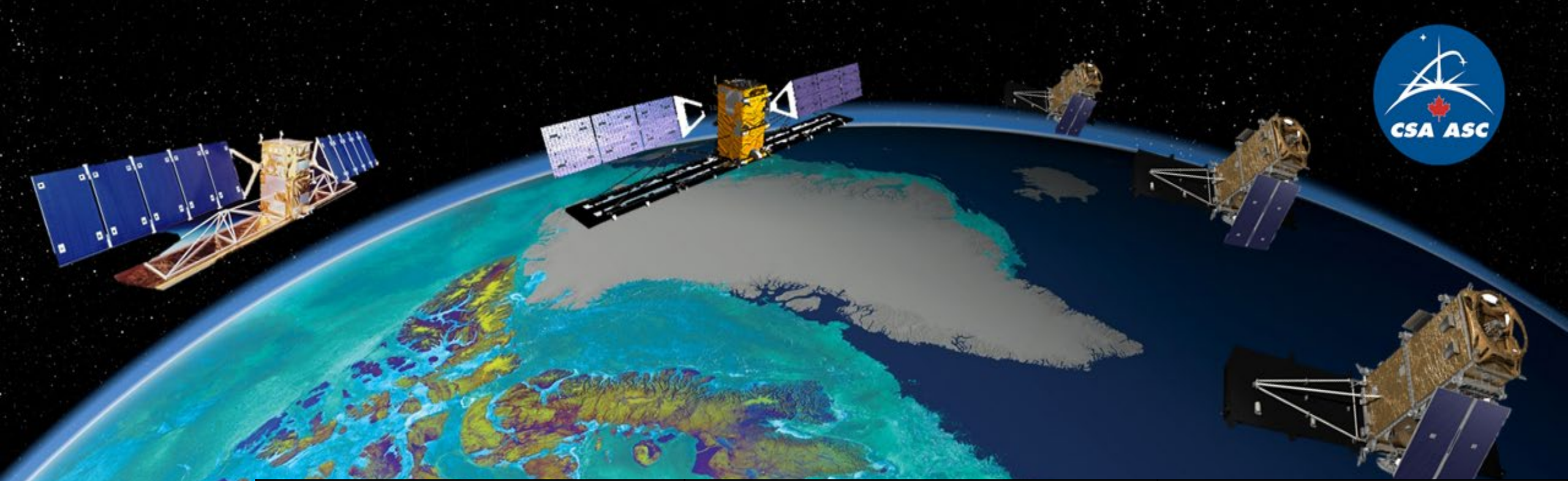
km

# RADARSAT Constellation Mission

- RCM is the evolution of the RADARSAT program with the objectives to:
  - ✓ *Ensure data continuity and improve system reliability*
  - ✓ *Respond to the increasing needs of the Government of Canada for SAR data to support operations and the timely delivery of products and services to Canadians*
- RCM is a government-owned mission, tailored to respond to the Canadian Government needs in 3 main areas:
  - ✓ *Maritime surveillance*
  - ✓ *Disaster management*
  - ✓ *Ecosystem monitoring*

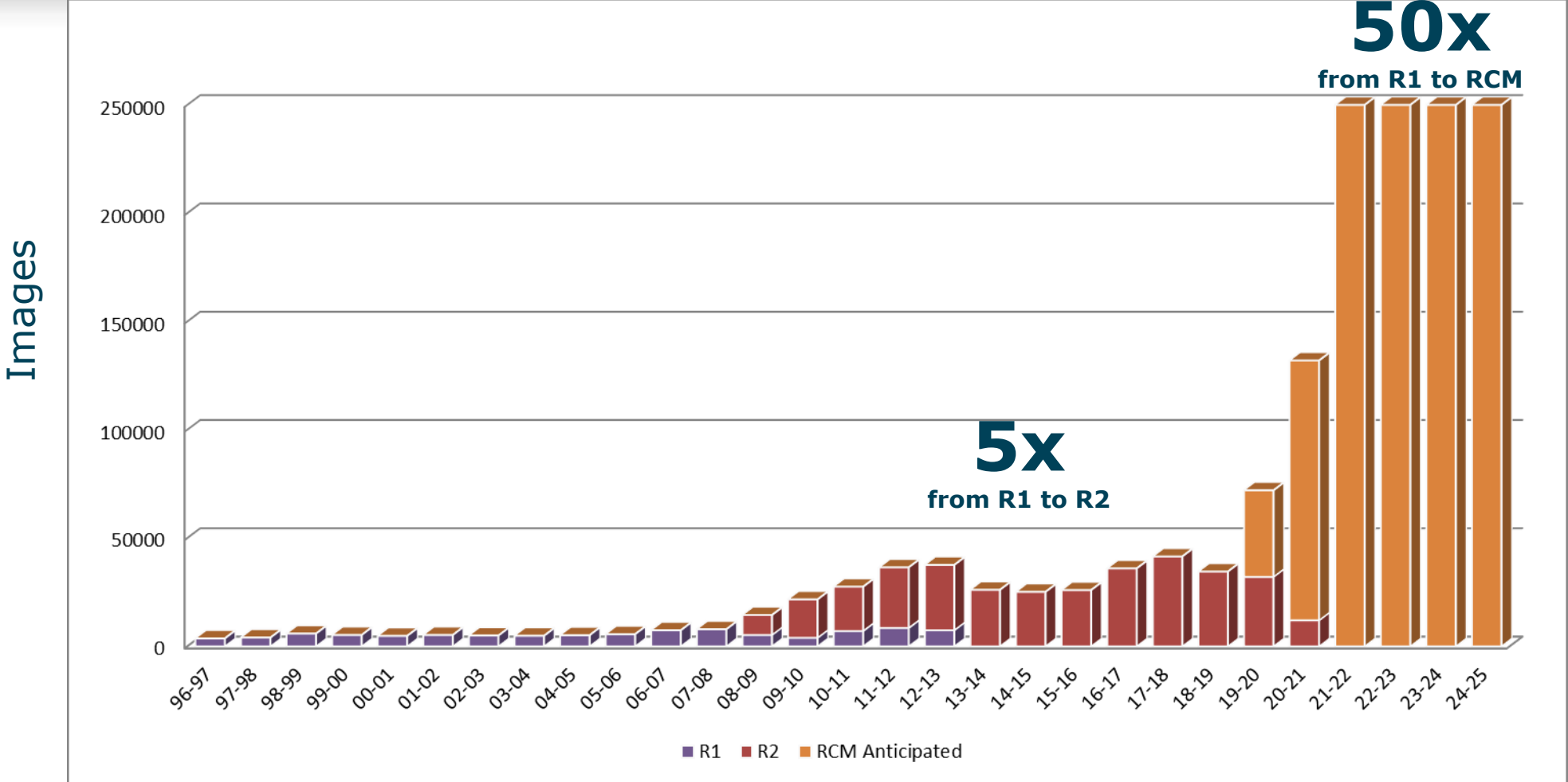
Canada



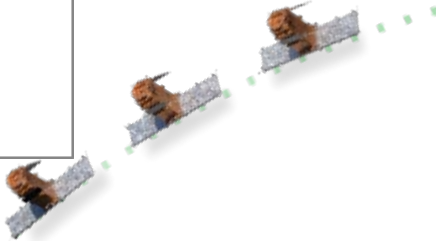


	<b>RADARSAT-1 (1995-2013)</b>	<b>RADARSAT-2 (2007 - )</b>	<b>RCM (2018)</b>
<b># of satellite</b>	1	1	3
<b>Mass</b>	2750 kg	2300 kg	1430 kg
<b>Exact revisit</b>	24 day	24 day	<b>4 day (12 / sat)</b>
<b>SAR time / orbit</b>	28 min	28 min	15 min / sat
<b>Antenna size</b>	15 m	15 m	6.75 m
<b>Polarization</b>	HH	<b>HH, VV, HV, VH</b>	<b>HH, VV, HV, VH, Compact Pol</b>
<b>Look direction</b>	Right	Right or <b>Left</b>	Right

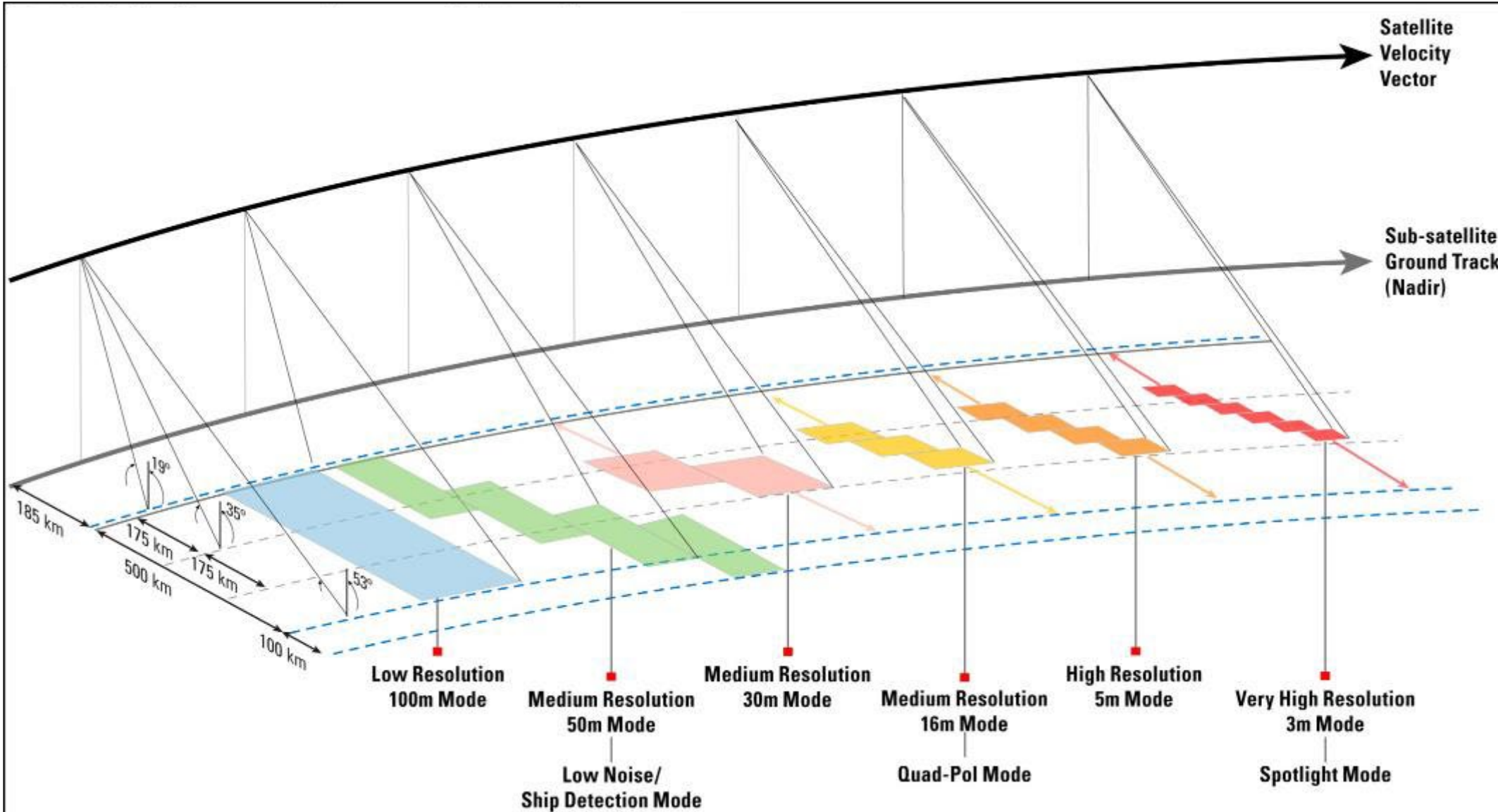
# Evolution of RADARSAT Data usage by Government of Canada



GoC user departments currently forecast that they will use approximately **250,000** RCM images per year.



# RCM SAR Imaging Modes

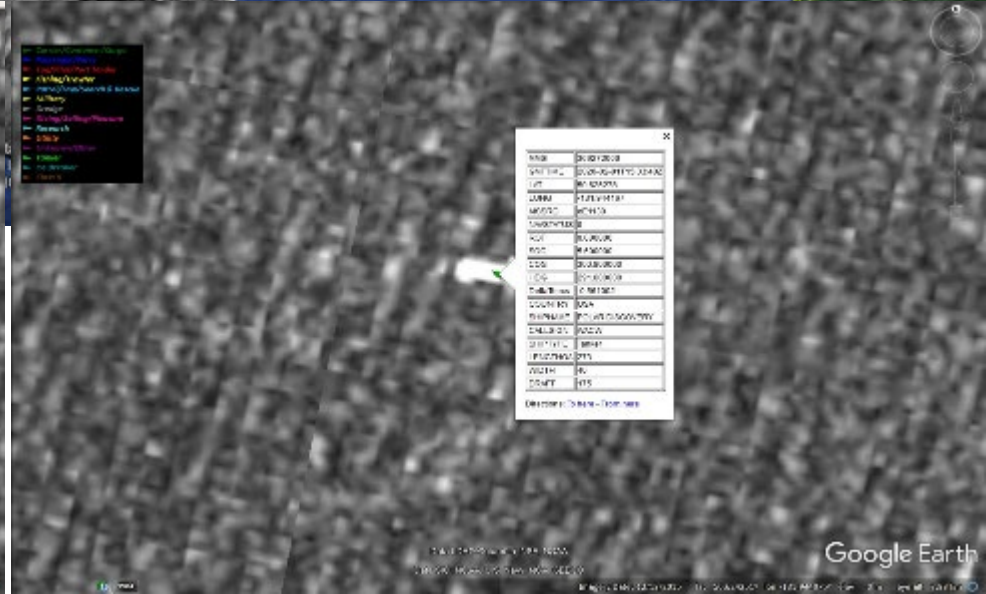
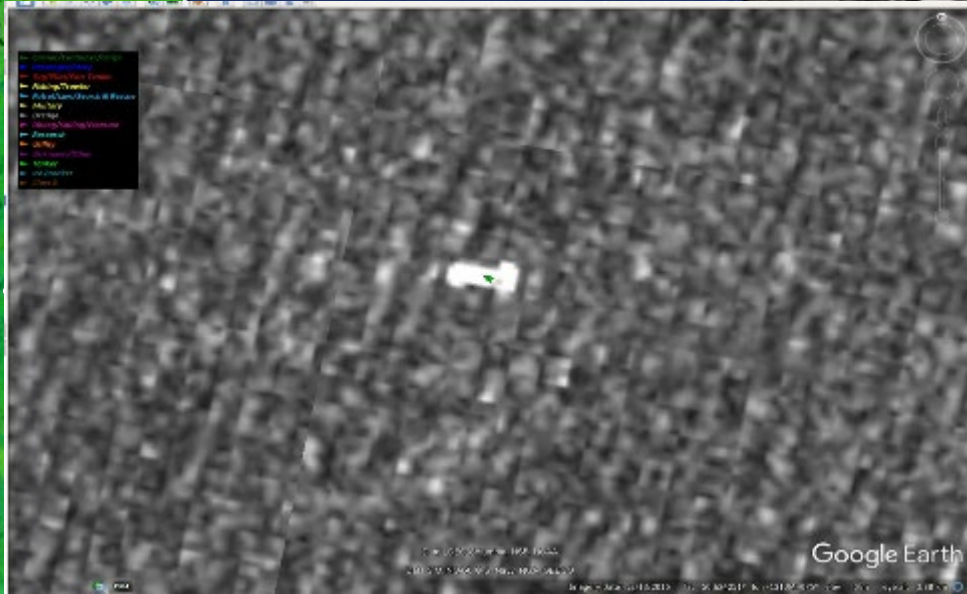
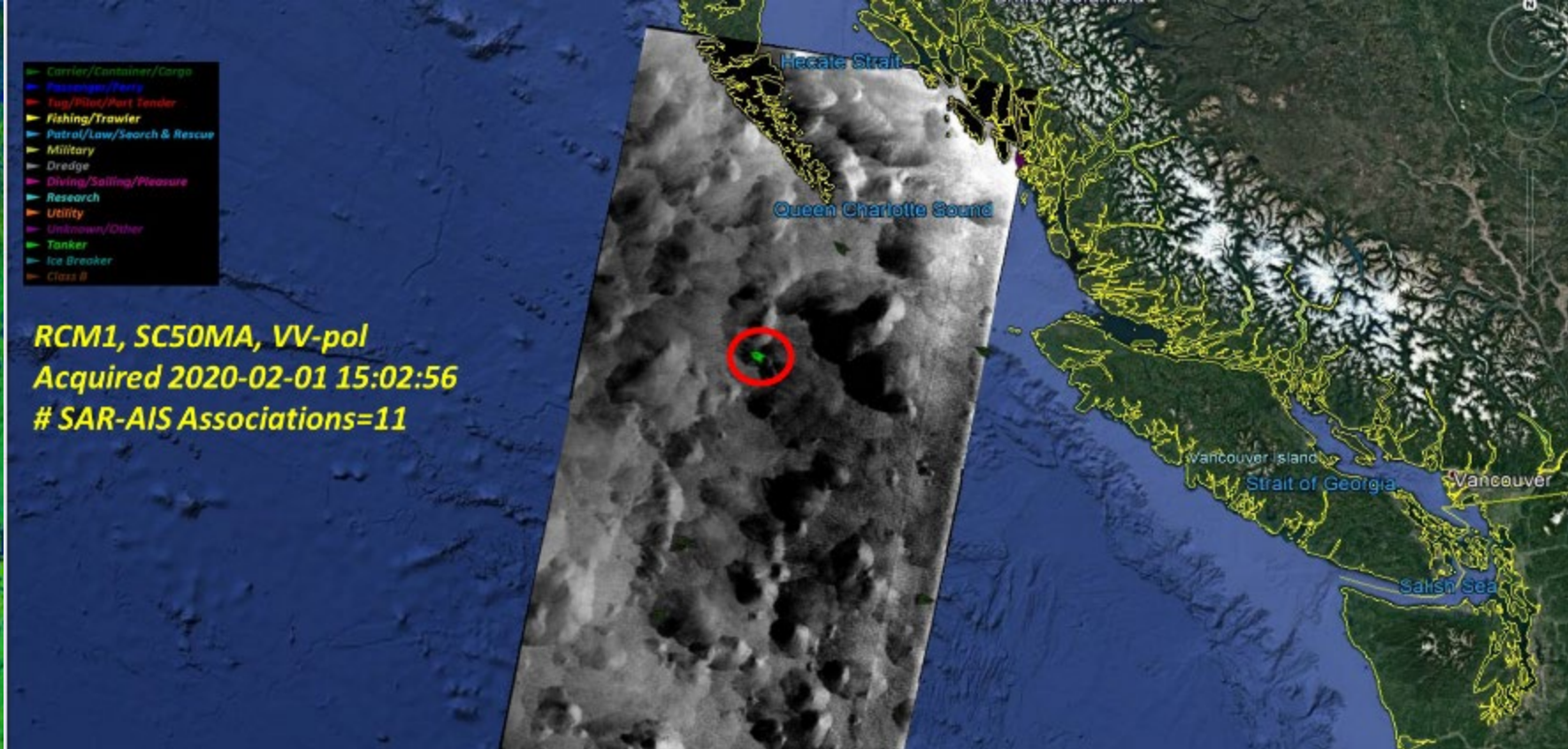


# Automatic Identification System (AIS)

- Each RCM satellite includes a receiver for AIS transmissions from vessels.
- Using AIS in conjunction with radar data will allow improved detection and tracking of vessels of interest.
- AIS is a National Defence sensor with access limited to the Government of Canada and their partners.

- Carrier/Container/Cargo
- Passenger/Tour
- Tug/Pilot/Port Tender
- Fishing/Trawler
- Patrol/Law/Search & Rescue
- Military
- Dredge
- Diving/Sailing/Plasure
- Research
- Utility
- Unknown/Other
- Tanker
- Ice Breaker
- Class B

**RCM1, SC50MA, VV-pol**  
**Acquired 2020-02-01 15:02:56**  
**# SAR-AIS Associations=11**







# Image Quality: Infrastructure

- Transponders

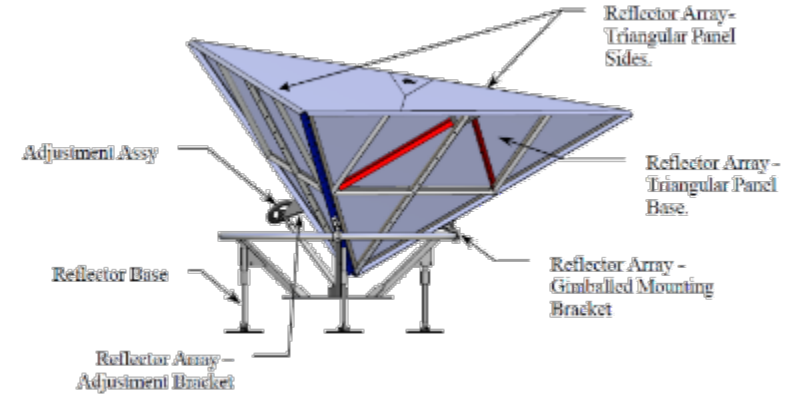
- Manufactured by DLR for RCM, currently in use for R2
- Deployed at two adjacent sites in St. Hubert
- Both visible in a single image frame of most RCM modes, in order to operate them simultaneously for increased measurement accuracy and facilitated polarimetric validation

- Image Quality Subsystem

- Successful FAT held in Dec. 2016, delivery at CSA in Q2 2018
- Enhancement of R2 IQS architecture, with RCM-specific functions

- Corner Reflectors

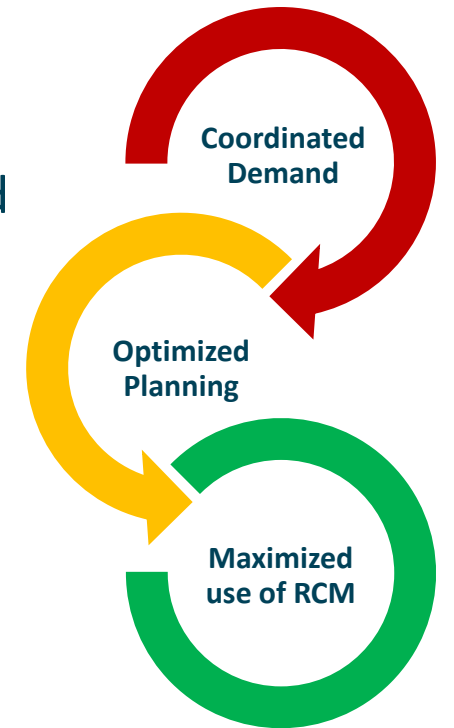
- Six identical 3.7m corner reflectors delivered by MDA
- Deployed in St. Hubert, Sweden and Alaska





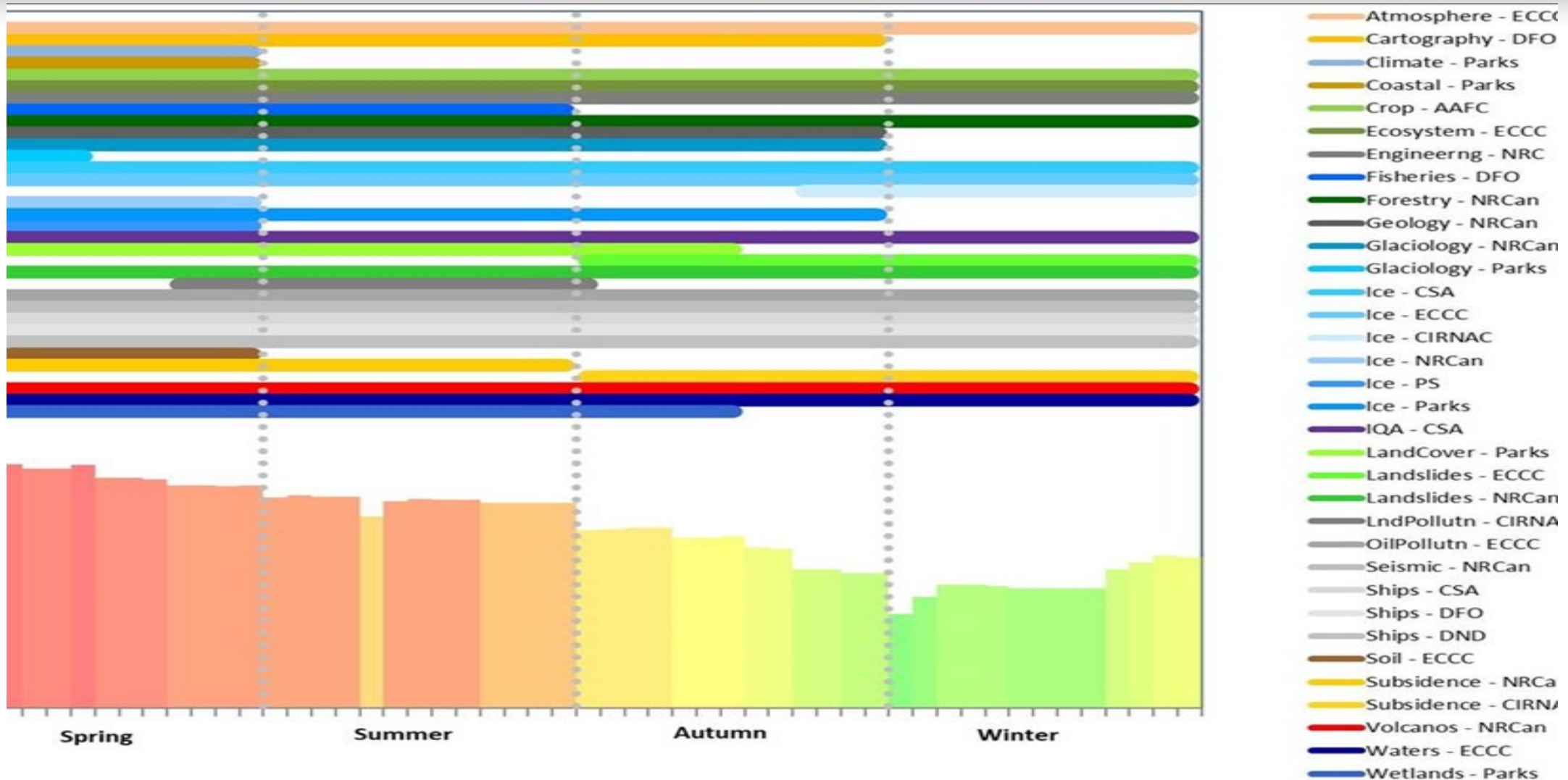
# Standard Coverages

- Being primarily designed for Government of Canada “operational purposes”, the RCM will systematically and recurrently image large areas in support of specific requirements
  - ✓ *Predominantly over the Canadian Area of Interest (AOI)*
  - ✓ *Designed to offer consistent and predictable SAR coverage*
  - ✓ *long-term data archive built for exploitation of information based on long time series*
- Standard Coverages consist of pre-defined and pre-planned data acquisitions plans that are based on a common set of parameters such as imaging modes and geographic areas
- Coverage plans are expected to be published on-line weeks/months ahead of acquisition (*unless restricted for security reason*)



# Current RCM Standard Coverages

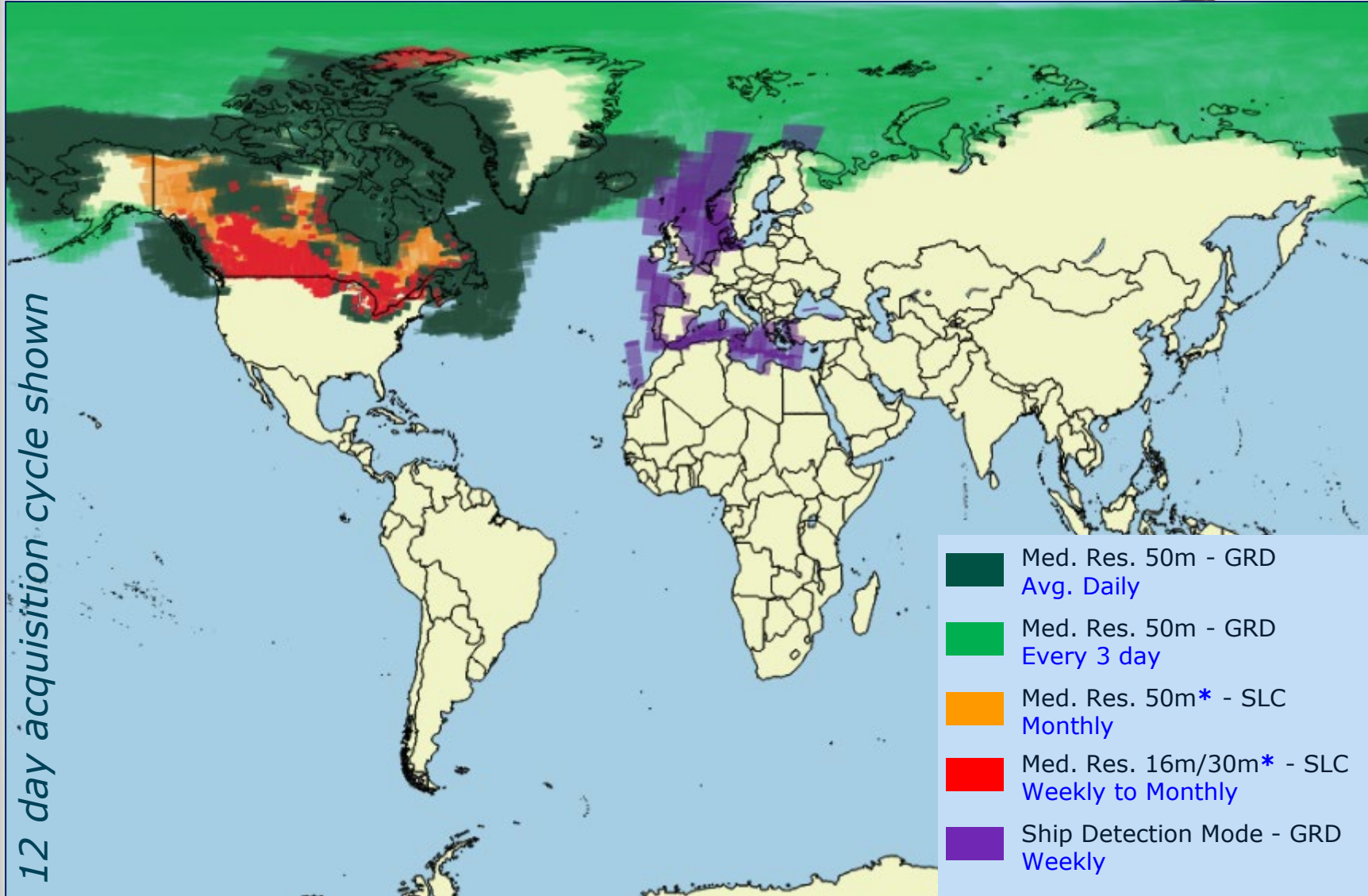
Active Periods over Annual Planning Cycle



# Overview Map

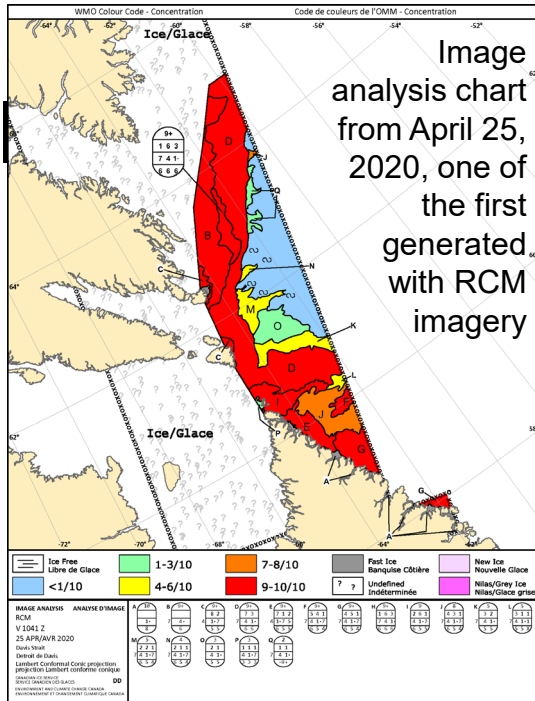
**Image Products**  
*resulting from*  
*Standard*  
*Coverages*

*Published 2 weeks*  
*in advance*



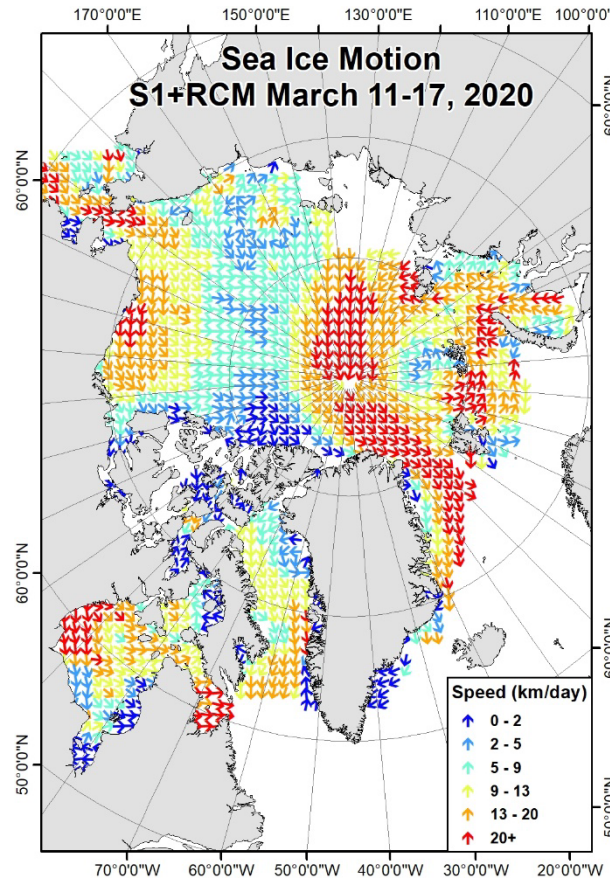


# Ice Monitoring



- RCM is the primary data source for all Canadian Ice Service charts and products since July 2020 (early products April 2020)
- Automated Iceberg Detection System implemented since 2018, reduced analysis time per image from 1.5 h to 15 min
- R&D into compact polarimetry for ice monitoring
- Development work on RCM image segmentation and machine learning for ice classification

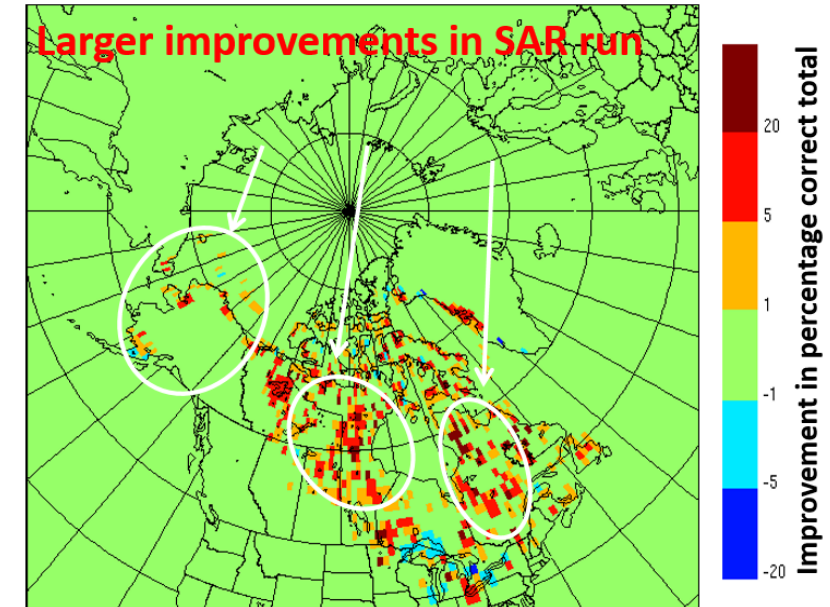
# Ice Dynamics



Pan-Arctic sea ice motion achieved by combining Sentinel-1 and the RADARSAT Constellation Mission

# Ice Data Assimilation

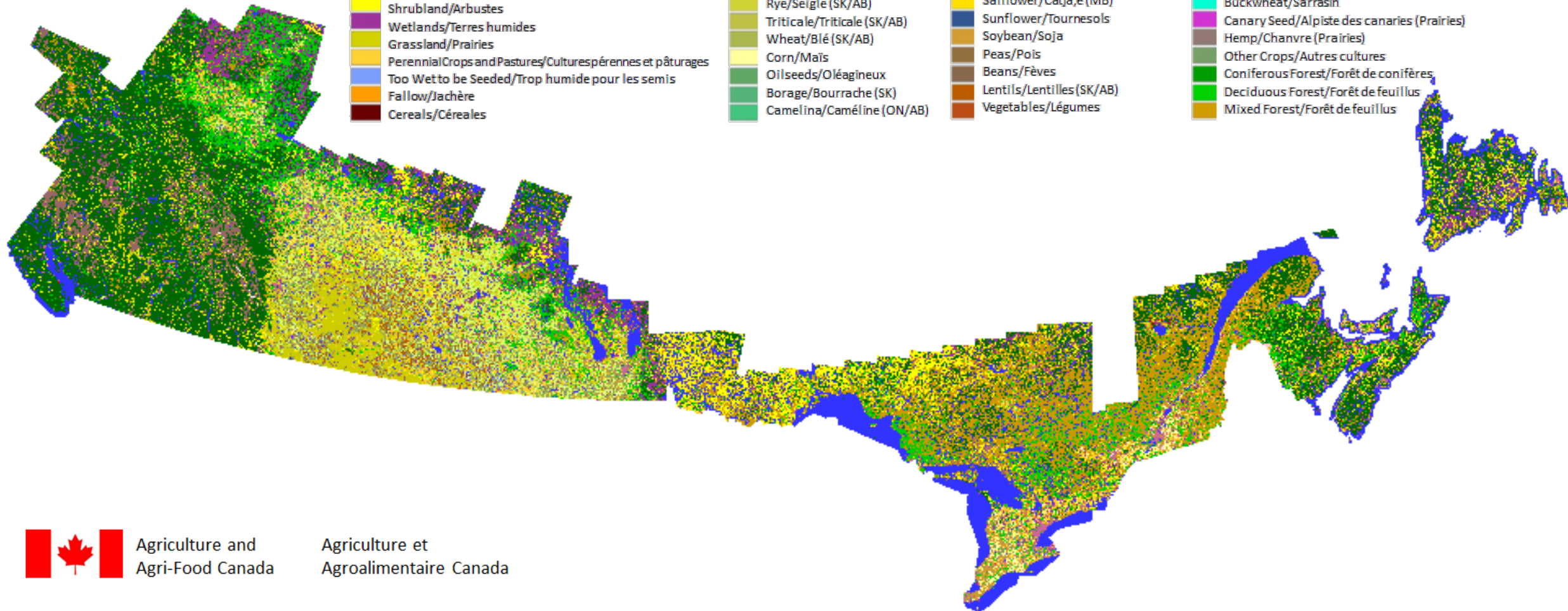
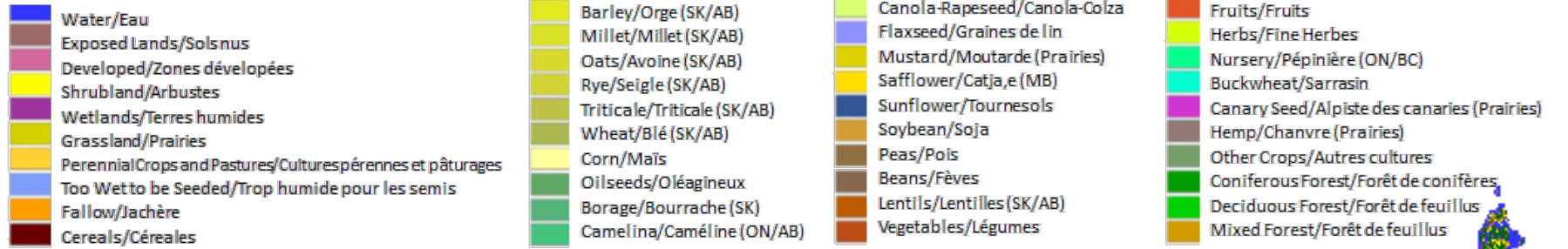
Difference between SAR and Control (no SAR) run  
Year 2013



- New techniques for automated extraction of ice information (concentration/type) from SAR were developed based on more than 15K of RADARSAT-2 images.
- Assimilation of SAR data over a year cycle improves ice analyses in the situations where high spatial resolution is important (e.g., near land and over small lakes) and where manual ice charts are not available.
- Six journal papers were generated from the project

# Agriculture & Agri-Food Canada AAFC Annual Crop Inventory

## Legend/Légende



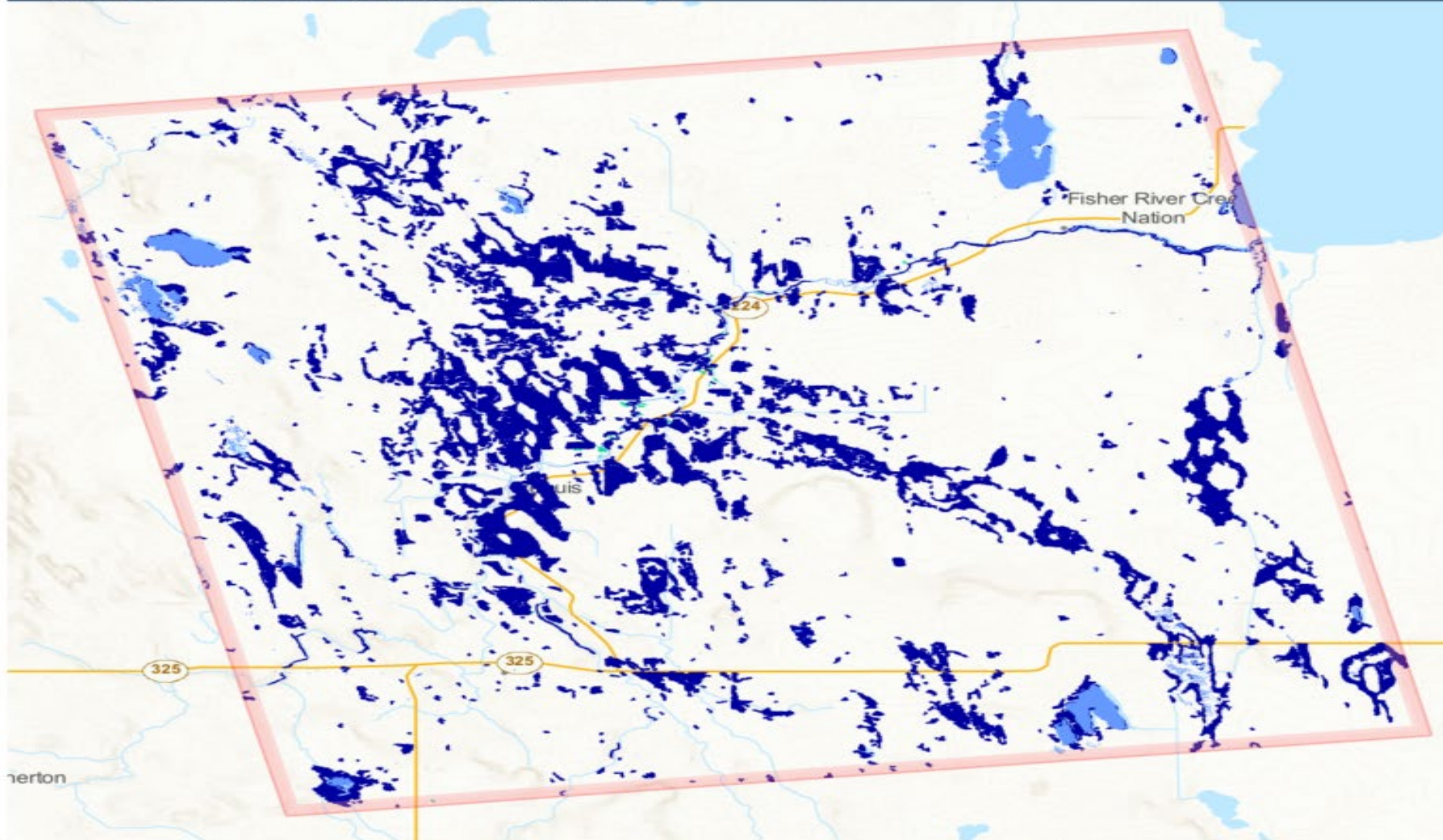
# RCM-1 derived flood extent - Fisher River Étendue des inondations extraite d'image RCM-1 - Rivière Fisher

Western Lake Winnipeg, MB  
Ouest du lac Winnipeg, MB

10 May 2022, 00:21 UTC / 10 mai 2022, 00:21 UTC

Floods in Canada / Inondations au Canada: <https://tinyurl.com/y28abtpg>

97° 29' 05" W / 51° 20' 36" N



## Flood extent / L'étendue des inondations

- Footprint / Empreinte au sol
- Permanent Water Bodies/Plan d'eau permanent
- Open Water Flood/Inondation en milieu ouvert
- Flooded Vegetation/Végétation inondée
- Urban Flood/Inondation en milieu urbain

0 2 4 6 8 10 12 14 km

Produced by the Canada Centre for Mapping and Earth Observation, Natural Resources Canada. / Produit par le Centre canadien de cartographie et d'observation de la Terre, Ressources naturelles Canada.

The open water flood products are derived from RCM-1 images with a system developed and operated by the Department of Natural Resources Canada. © All rights reserved. / Les produits de l'étendue des eaux libres liés aux inondations sont réalisés à partir d'images RCM-1, à l'aide d'un système mis au point et exploité par le Ministère des Ressources naturelles du Canada. © Tous droits réservés.

RCM RADARSAT Constellation Mission Data and Products © Government of Canada (2022) - All Rights Reserved. Official mark of CSA.





# New Systematic 30m Land Standard Coverage

- Active from April to December of each year
- Parameters: 12-d revisit, Med Res 30m, Compact Polarization, MLC format (32-bit)
- Average of 56 scenes/day
- MLC 32-bit format:
  - Medium product sizes (~830 MB)
  - Easy visualization and handling (compared to SLC, which can have hundreds of individual burst images in a single product)
  - No distorted rendering over dynamic range

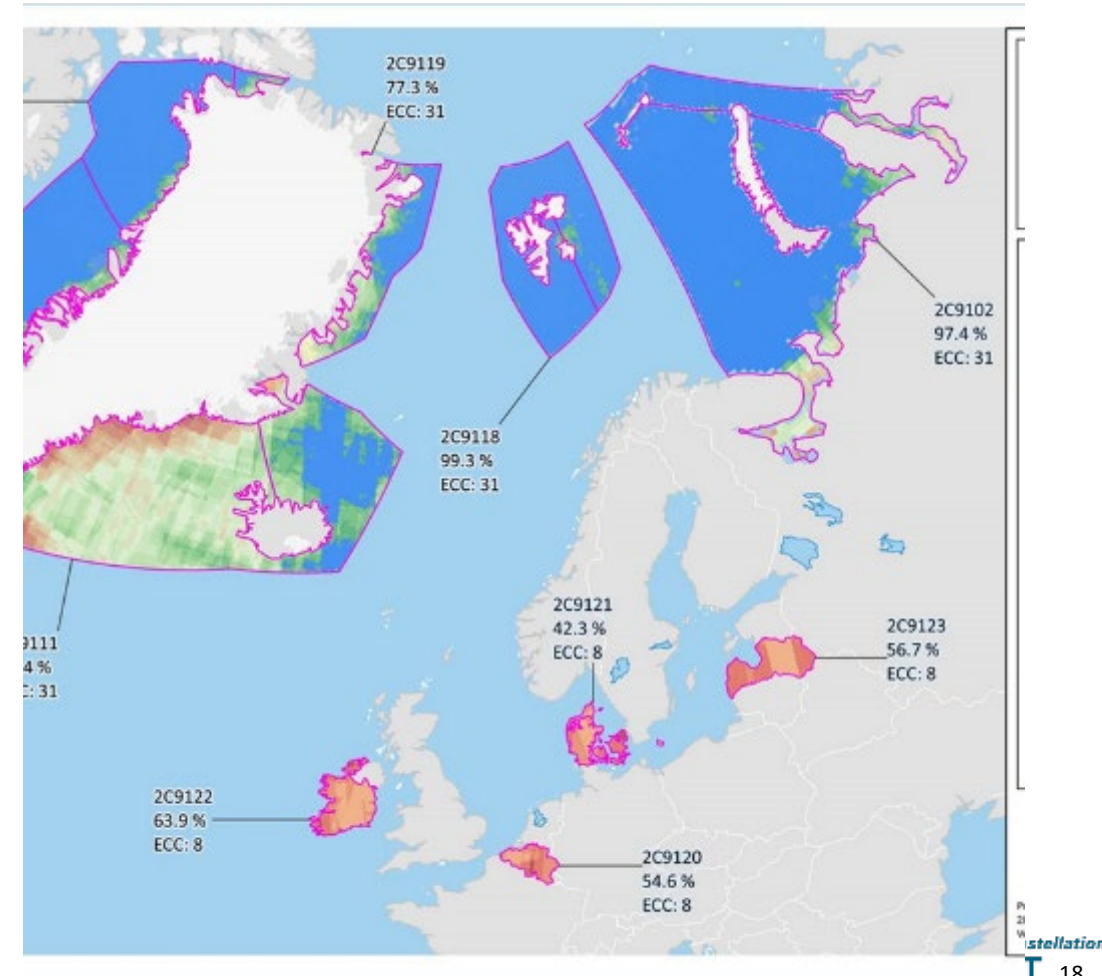




# ESA observation requirements for RCM



- The RCM support to European needs started in Jan 2021, for Copernicus sea-ice monitoring, and is on-going
- Following the Sentinel-1B anomaly (23/12/2021), the RCM coverage frequency of relevant sea-ice areas was increased, starting in Feb 2022 with a daily revisit
- In addition, the European Commission asked for RCM data coverage over specific European areas to evaluate the suitability of the mission to support the monitoring of agricultural activities in the context of the EU Common Agricultural Policy (CAP) which started on April 10<sup>th</sup> with a 4 day revisit



- Received over 800 scene's product through JAXA from Canada EODMS (As of Nov.11,2021)
- Evaluating the RCM data on ship detection and the affect on radio wave noise.
- Operating "RCM data transfer system of JAXA" to deliver RCM data from EODMS to JCG server.(from Oct.12,2021)

EODMS web site <https://www.eodms-sgdot.nrcan-rncan.gc.ca/index-en.html>

Government of Canada / Gouvernement du Canada

Search the website

Franglais

MENU Fullscreen

Canada.ca > Natural Resources Canada > Maps, Tools and Publications > Satellite imagery and air photos

Start Search x Results x

Map Options Welcome shinichi

Review Search Results

Footprint on Map	Order	Satellite (Click to zoom)	Date	Beam Mode Description
<input type="checkbox"/>	<input type="checkbox"/>	RCM	2021-11-10 21:01:24 GMT	ScanSAR 50m Resolution 350km Sw
<input type="checkbox"/>			2021-11-10	

Product detail information

Order ID: 90863 (5 Items), Date Submitted: 2021-11-11 07:00:23 GMT

684768	RCM2_OK1694292_PK1854425_1_SC5	AVAILABLE FOR DOWNLOAD
684769	RCM2_OK1694292_PK1853404_1_SC5	AVAILABLE FOR DOWNLOAD
684770	RCM3_OK1694292_PK1853699_1_SC5	AVAILABLE FOR DOWNLOAD
684772	RCM2_OK1694288_PK1854527_1_SC5	AVAILABLE FOR DOWNLOAD
684771	RCM2_OK1694292_PK1854425_2_SC5	AVAILABLE FOR DOWNLOAD

Order ID: 90697 (5 Items), Date Submitted: 2021-11-10 19:00:22 GMT

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683440	RCM2_OK1694292_PK1853404_1_SC5	AVAILABLE FOR DOWNLOAD
683442	RCM2_OK1694288_PK1852013_1_SC5	AVAILABLE FOR DOWNLOAD
683439	RCM3_OK1694292_PK1853699_1_SC5	AVAILABLE FOR DOWNLOAD

Item Details

Order ID: 90863  
Item ID: 684768  
Product ID: 12766120  
Service: AD HOC  
Name: RCM2\_OK1694292\_PK1854425\_1\_SC50MC\_20211110\_210C  
Date Submitted: 2021-11-11 07:00:23 GMT  
Date Updated: 2021-11-11 07:02:39 GMT  
Status: AVAILABLE FOR DOWNLOAD  
Product is available for download.

Parameters

packagingFormat: ZIP  
NOTIFICATION\_EMAIL\_ADDRESS: Z-alos-2\_rcm@ml.jaxa.jp  
ArchiveImagId: 3642518  
ParentItemid: 684764

Priority: Medium

Delivery Destination(s):  
[https://data.eodms-sgdot.nrcan-rncan.gc.ca/public/carts/501abe36-fb-db2fabca7f2/684768/RCM2\\_OK1694292\\_PK1854425\\_1\\_SC50MC\\_](https://data.eodms-sgdot.nrcan-rncan.gc.ca/public/carts/501abe36-fb-db2fabca7f2/684768/RCM2_OK1694292_PK1854425_1_SC50MC_)

Prime Minister  
How government works  
Open government

39.87642°N 125.76392°E

# RADARSAT Constellation Mission (RCM)

A strategic asset for Canada

# 70

GC Programs & Services rely on a regular and predictable source of SAR imagery

# 12

GC Departments

# 250 000

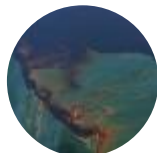
SAR scenes/yr used by GC

A **50 fold** increase when compared to RADARSAT 1 and demand is ever growing.

RCM imagery is an integral part of many GC service delivery and support to policy



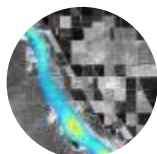
Ice & Icebergs detection & dynamics



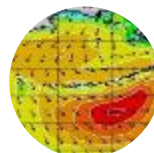
Oil detection & tracking



Maritime features and surveillance



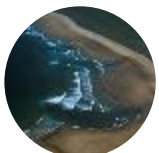
Infrastructure monitoring



Wind data



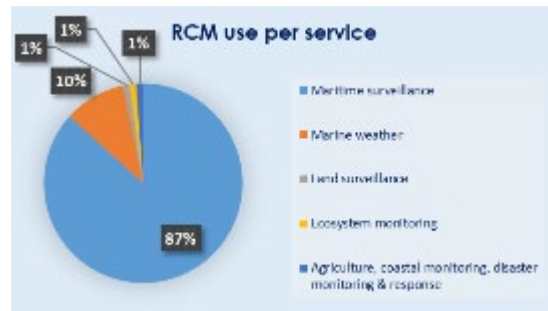
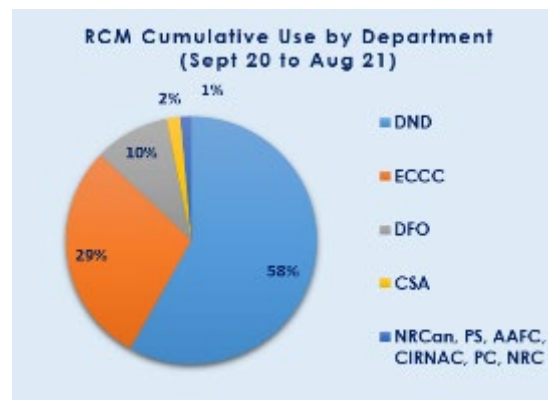
Agriculture and food systems



Wet/Humid



Support to emergency response



RCM Vetted Users

# 161

# 86

Industry & Academia

# 16

International

# 13

Province & Territories

# 46

NPO & Sharing Partners

# RCM Users' Forum overview

## Wednesday 18<sup>th</sup>

### 09h00 – Introduction

### 09h20 – Mission status update

1. RCM data services
2. Standard coverages
3. Acquisitions plans
4. Image quality
5. RADARSAT Service Desk
6. NRCAN/EODMS
7. R1 Archives Access
8. EOSC Beyond the RCM
9. RCM Applications

### 12h00 – Lunch

### 13h00 – GC users' presentations

1. Agriculture and Agri-Food Canada
2. Environment and Climate Change Canada
3. Public Safety Canada
4. Fisheries and Oceans Canada/Environment and Climate Change Canada - SWOT

### 14h30 – Users' presentations

1. Government of British Columbia
2. C-CORE
3. Dromadaire Géo Innovations
4. Skywatch

### 17h00 – End of 1st day

## Thursday 19<sup>th</sup>

### 09h00 – Introduction

### 09h10 – International partners presentations

1. European Space Agency
2. Japan Aerospace Exploration Agency
3. NASA - Goddard Space Flight Center
4. NOAA - National Environmental Satellite, Data, and Information Service

### Users' Discussion

### 11h30 – Close out

Over 180 Participants

# Thank-You

## Websites:

<https://www.asc-csa.gc.ca/eng/satellites/radarsat/default.asp>

<https://www.asc-csa.gc.ca/eng/satellites/radarsat/what-is-rcm.asp>

## Data Access:

**EODMS:** <https://www.eodms-sgdot.nrcan-rncan.gc.ca/sp-pe.html>

## Future Data Acquisition plans:

[Acquisition plans of the RADARSAT Constellation Mission - Open Government Portal \(canada.ca\)](#)

## Videos:

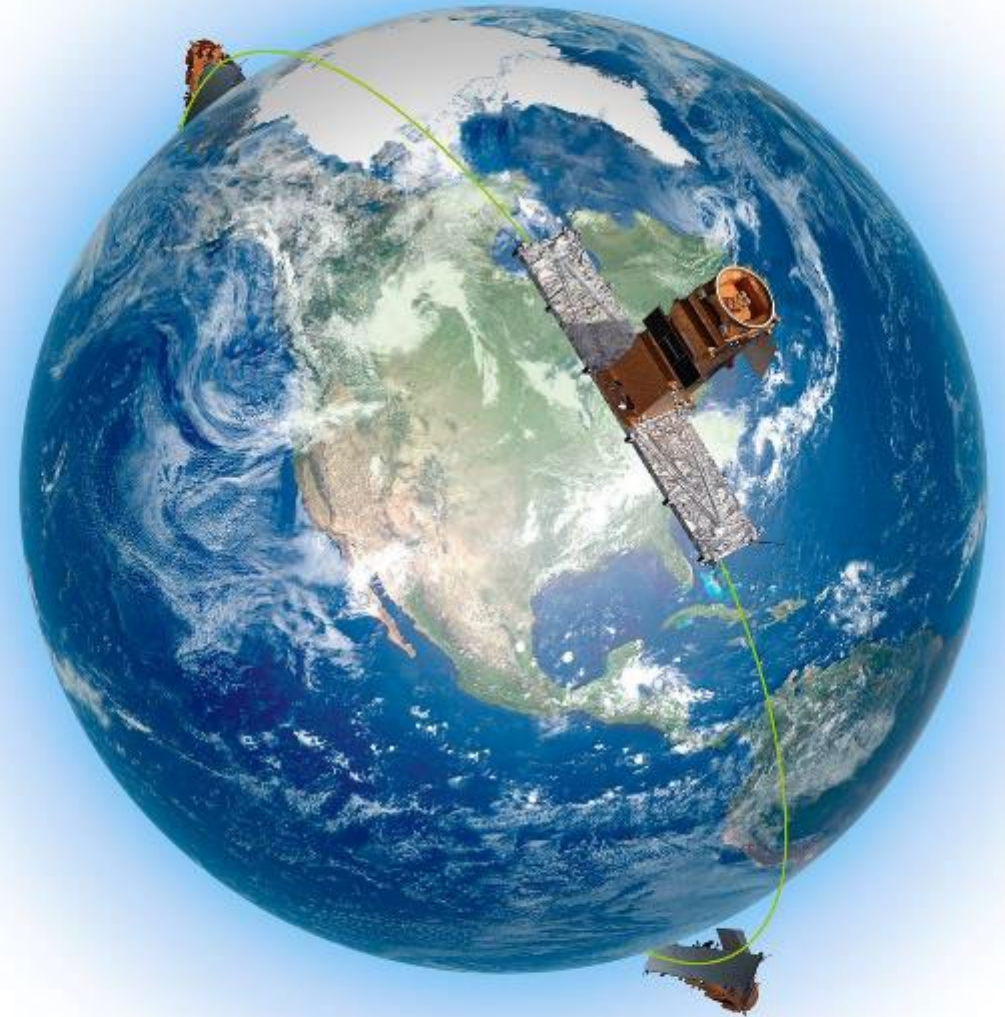
**Launch:** <https://www.youtube.com/watch?v=gszJYTNtzLo>

**Applications (En):** <https://www.youtube.com/watch?v=VGQp4iiKMJY>

**Applications (Fr):** [https://www.youtube.com/watch?v=ybL\\_L-PhhPs](https://www.youtube.com/watch?v=ybL_L-PhhPs)

**Sample dataset:** [ftp://ftp.asc-csa.gc.ca/users/OpenData\\_DonneesOuvertes/pub/RCM/](ftp://ftp.asc-csa.gc.ca/users/OpenData_DonneesOuvertes/pub/RCM/)

RCM information and news on the CSA website: [www.asc-csa.gc.ca](http://www.asc-csa.gc.ca)



# Canadian Space Agency



# Agence spatiale canadienne