



Natural Resources
Canada

Ressources naturelles
Canada

Satellite Earth Observation in Action: Geointelligence in Disaster Management

EMGCP Meeting

May 15th, 2025

Simon Tolszczuk-Leclerc

Emergency Geomatics Service

Canada Center Mapping Earth Observation

Canada

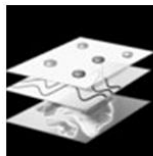


Canada Centre for Mapping and Earth Observation

Provide Canadian governments, researchers, businesses, communities, and individuals access to high quality, authoritative, and interoperable geospatial data and methods to meet a growing range of needs and applications



Satellite Data
Reception and
Archiving (EODMS)



Core
Foundational
Data



Scientific
Research

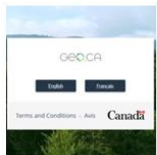
Artificial Intelligence



Policies,
Standards &
Program Integrity



Flood Mapping
and Emergency
Management



Geo.ca



Open Geospatial
Applications and
Technologies



Geographical
Names Board of
Canada

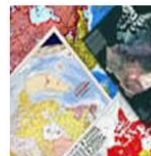
Data onboarding
and dissemination



National Air
Photo Library

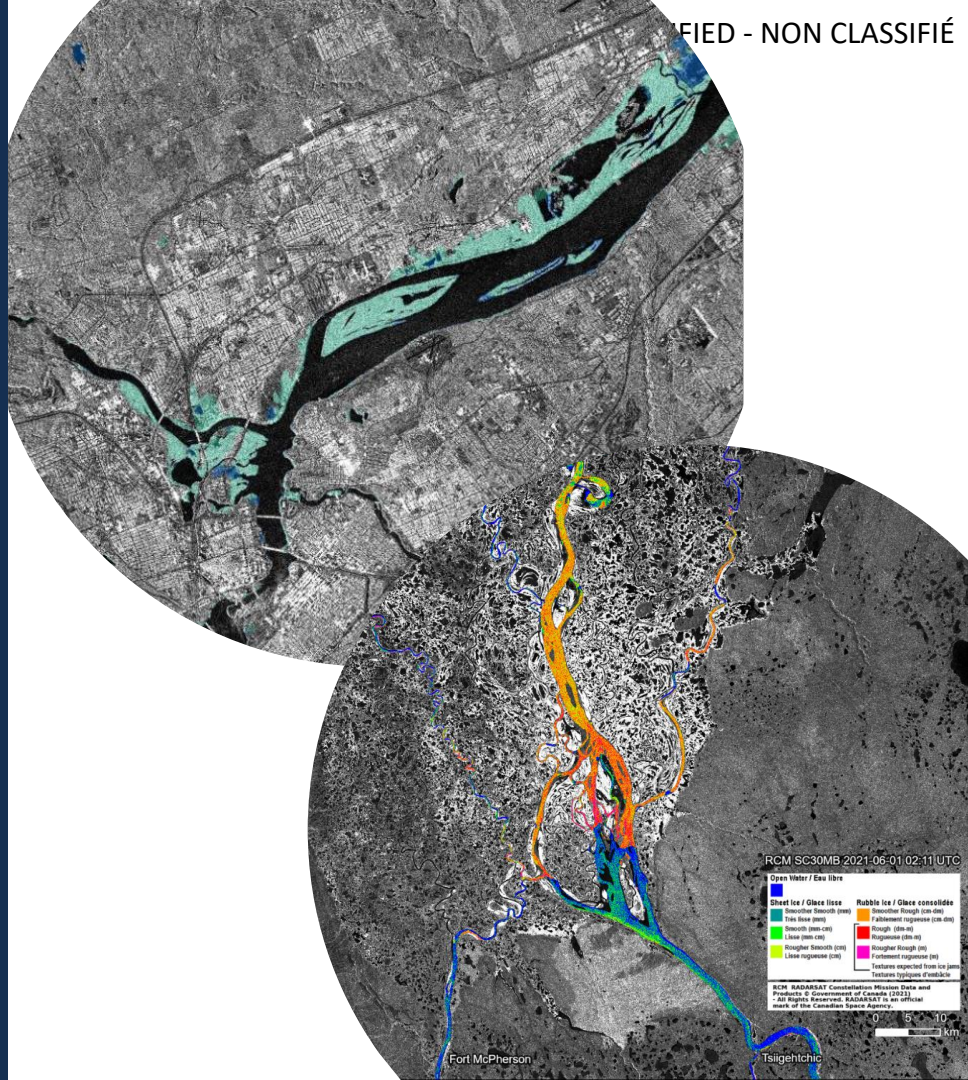


Canada Map
Office



CCMEO's Emergency Geomatics Service (EGS)

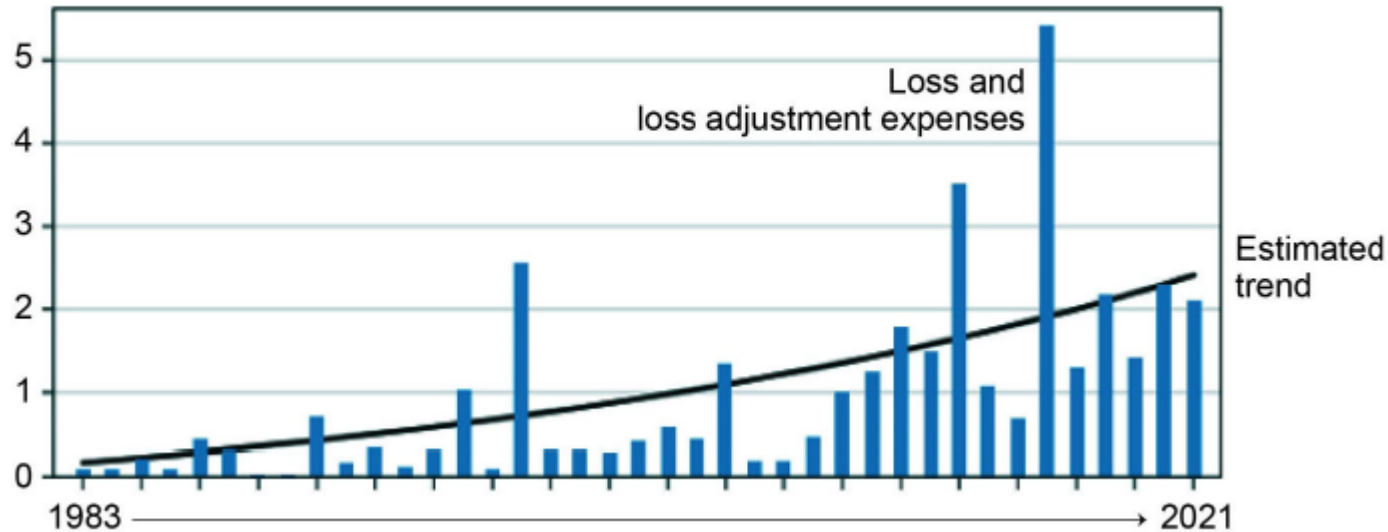
- EGS is a critical service providing satellite-based mapping and geospatial analysis to support emergency disaster response and monitoring.
- The EGS enhances situational awareness by providing accurate, near real-time, satellite-based geospatial information.
- Several stakeholders can activate our emergency management plan to receive support



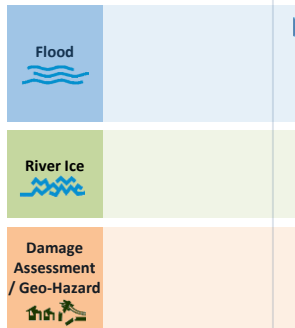
EGS: More than 70 disasters since 2004

Number
of Image
Acquisitions

Figure 2: Insured losses due to extreme weather events in Canada 1983-2021
Canadian dollars in billions at 2021 value



Source: Canada National Risk Profile, 2023



25 years of RADARSAT

The RADARSAT program has been a beacon of Canadian leadership, establishing the RADARSAT brand name around the world and confirmed a Canadian presence in the aerospace world theatre



Timeline	1995 – 2013	2007 – operational	2019 – operational	Post 2026
Business Model	Government of Canada owner and operator	MDA owner, operator GC up front investment in exchange for imagery credits	Government of Canada owner and operator	Diversified, hybrid
Satellite Configuration	1 C band SAR satellite 800 km	1 C band SAR satellite 800 km	3 C band SAR satellites + AIS 600 km	Combination of free & open, commercial purchase, int'l partnerships and sovereign sensor(s)
Satellite Capabilities	8 – 100 m resolution	1 – 100 m resolution	Improved reliability Increased re-visit frequency	Improved reliability and resiliency Increased re-visit frequency
Observation priorities	Ice monitoring Disaster management Environment monitoring	Ice monitoring Ship detection Crop mapping	Maritime surveillance Ecosystem monitoring Disaster management	Maritime surveillance Land surveillance Marine weather Ecosystem monitoring Agriculture Coastal monitoring Disaster management
GC Scenes/yr	5 000	50 000	300 000	300 000 +
GC user departments	NRCan, EDOC	DND, EDOC, NRCan, DFO, AAFC	DND, EDOC, NRCan, DFO, AAFC (growing)	EDOC, NRCan, DFO, AAFC



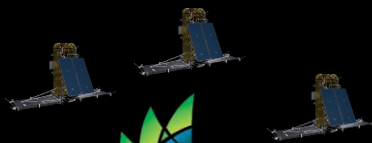
EGS Core Satellites



LANDSAT



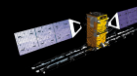
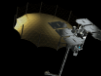
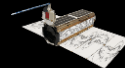
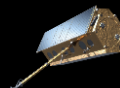
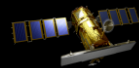
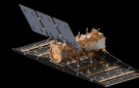
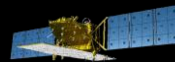
SENTINEL



RADARSAT



RADARSAT



COMMERCIAL

INTERNATIONAL
DISASTER
CHARTER



Capella Space



SATELL¹OGIC[®]

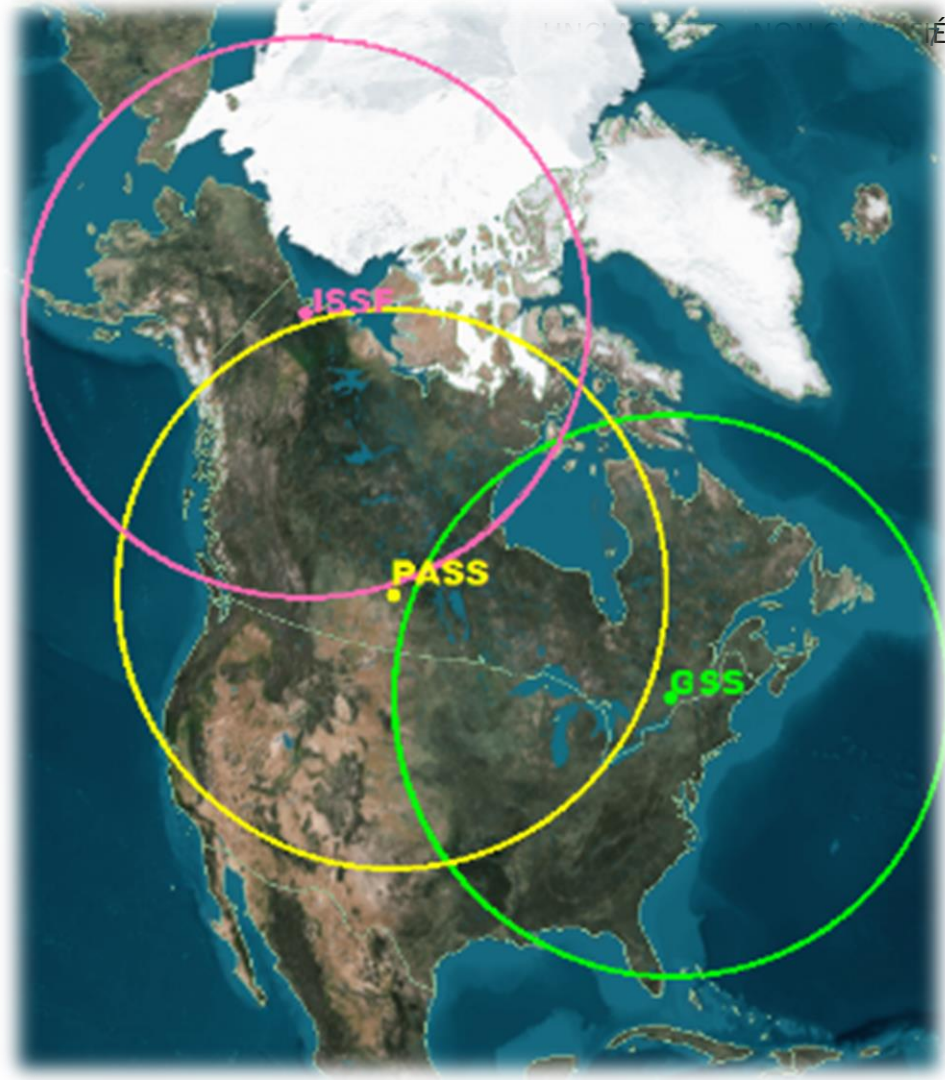


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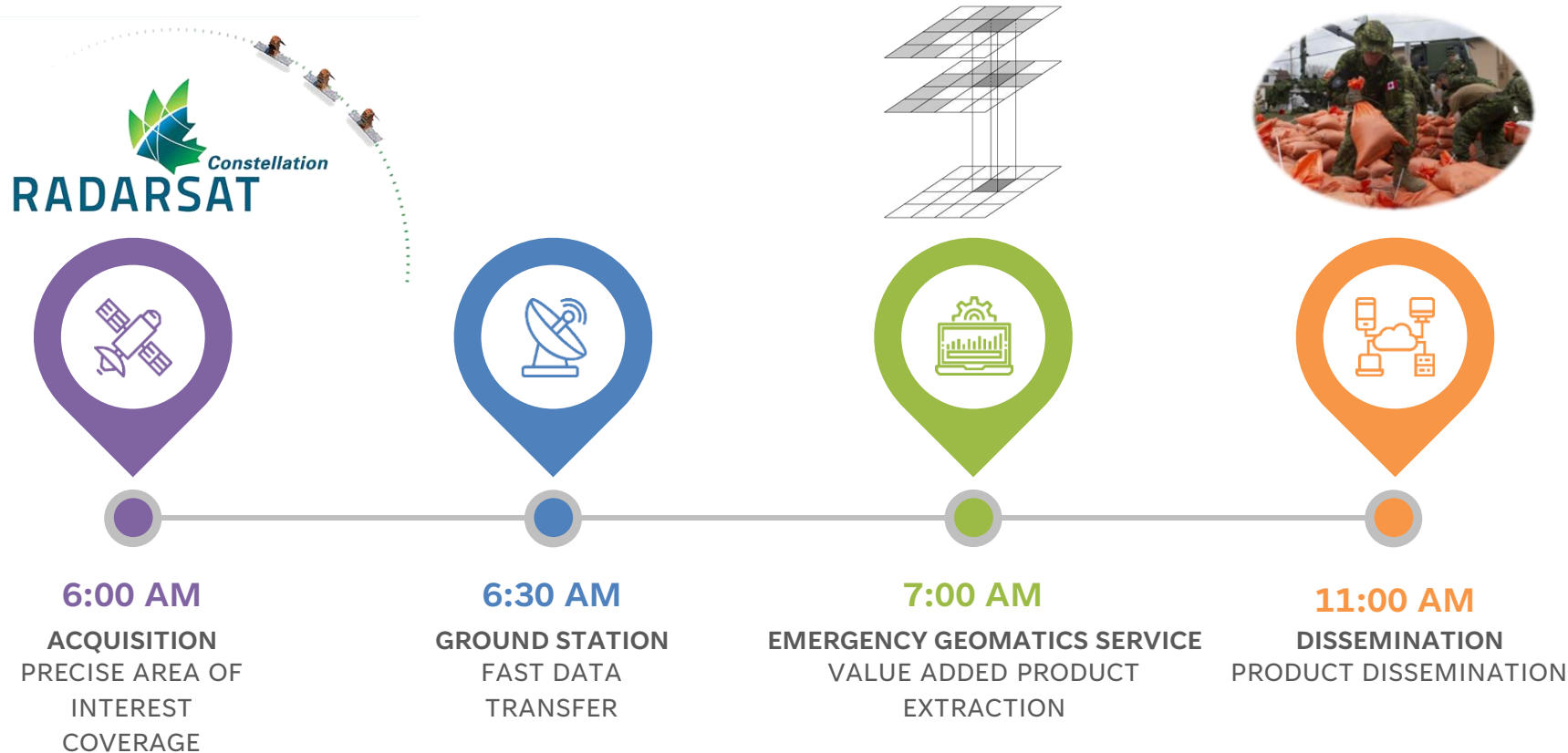
MAXAR

NRCan Satellite Ground Segment

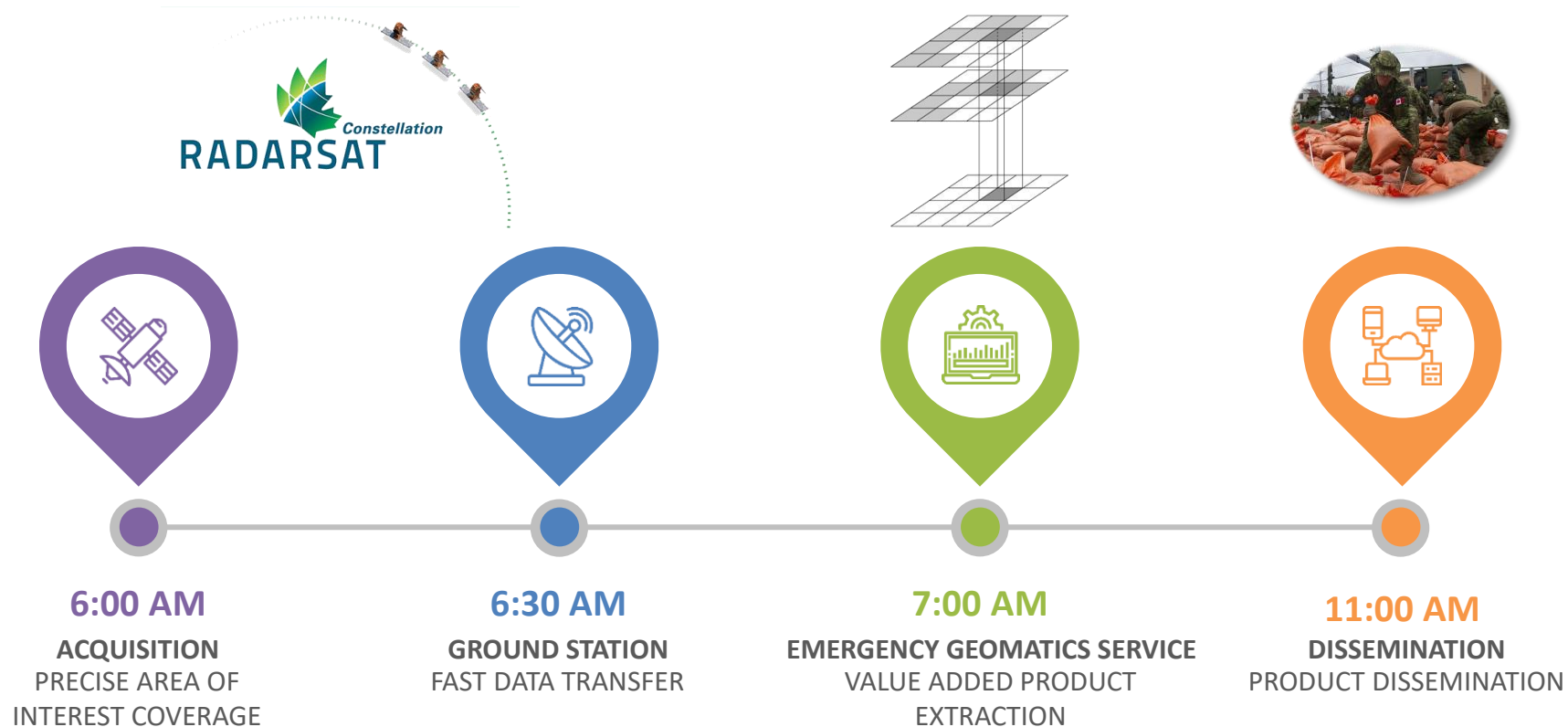
- National ground segment for civilian RADARSAT data
- Three stations make up a network to support various satellite missions, including RCM and RADARSAT-2.
 - Gatineau
 - Prince Albert
 - Inuvik
- Hosts the national Radarsat archive on the Earth Observation Data Management System (EODMS)



End-to-End Workflow for Near Real-Time Emergency Mapping

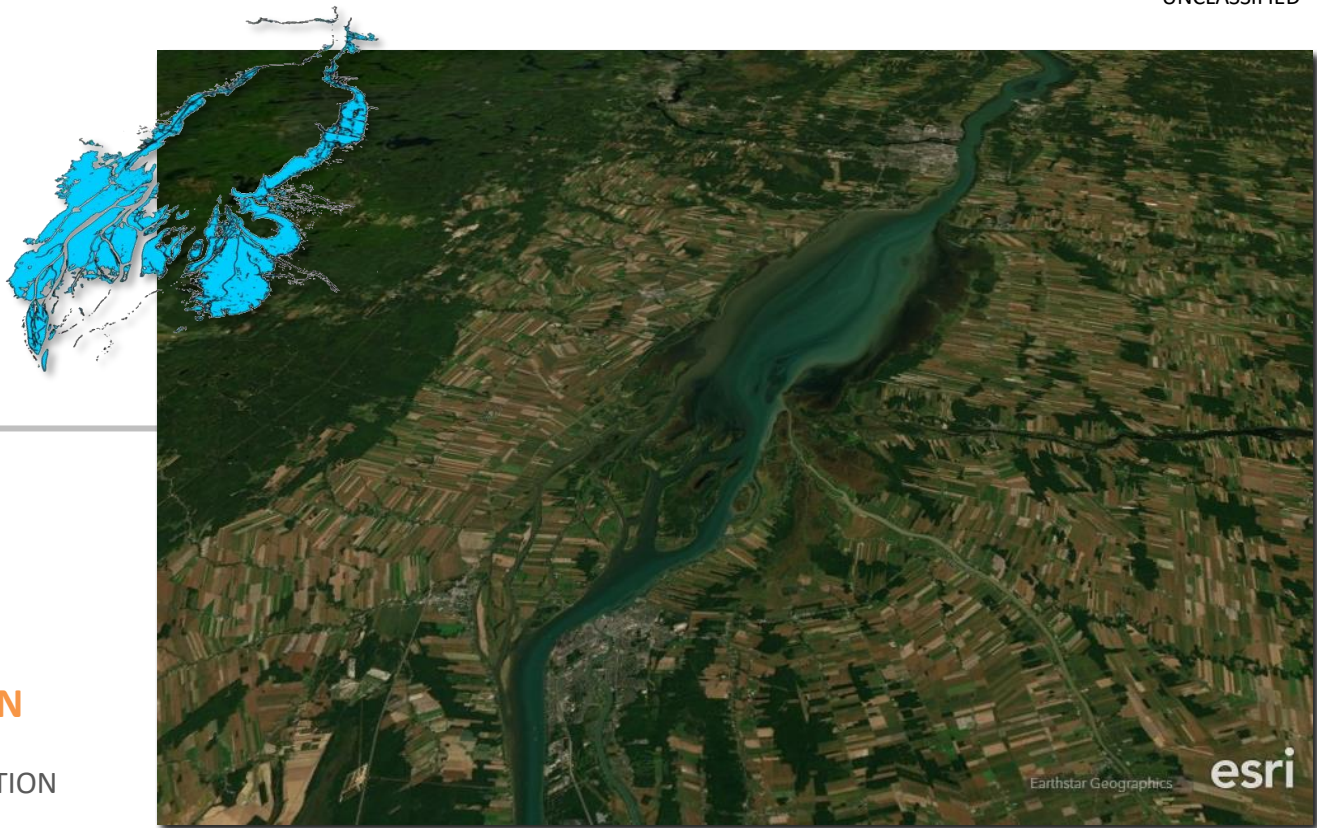


Demands for this service are increasing as Canada works to more fully leverage Satellite Earth Observation.



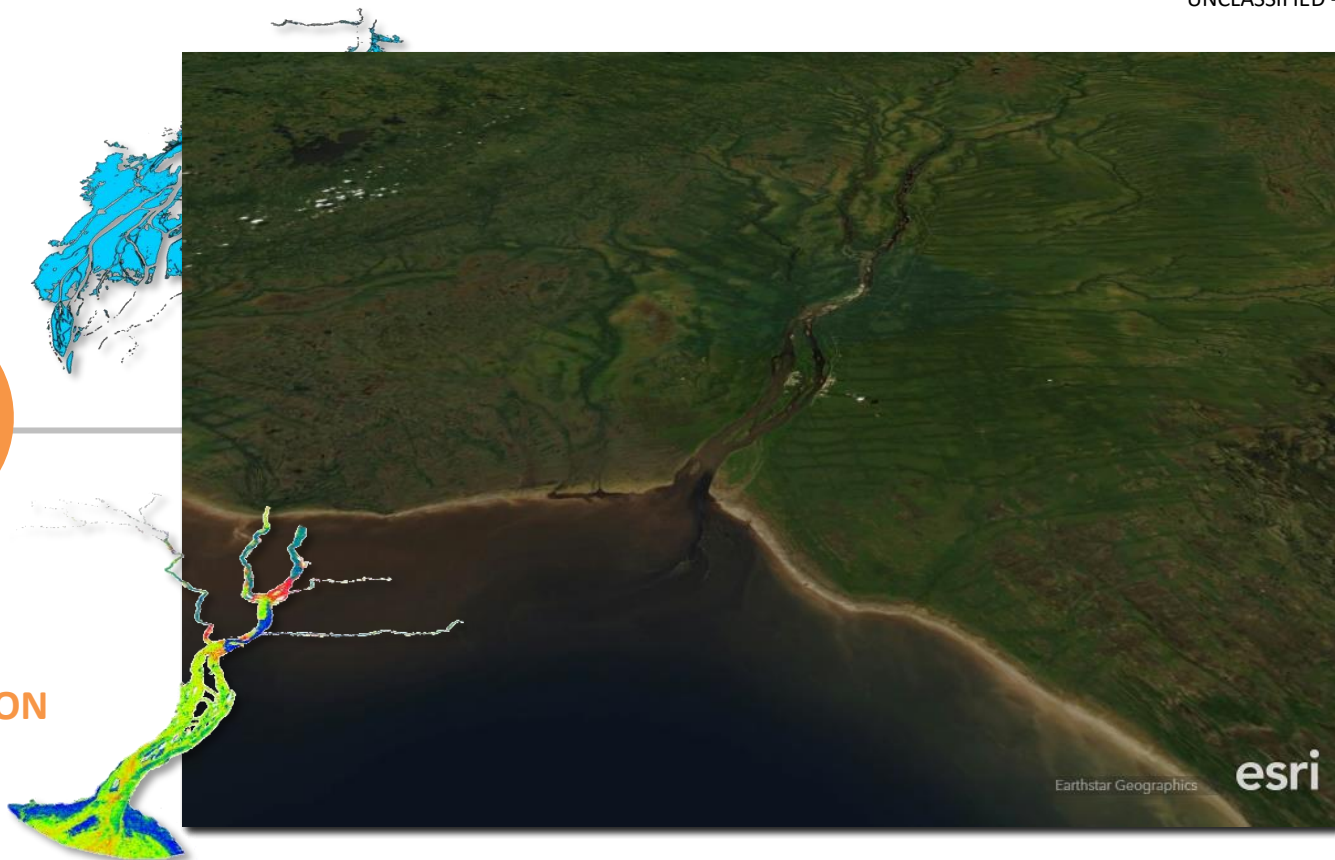


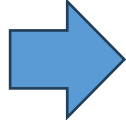
DISSEMINATION
DISSEMINATION
PRODUCT DISSEMINATION





DISSEMINATION





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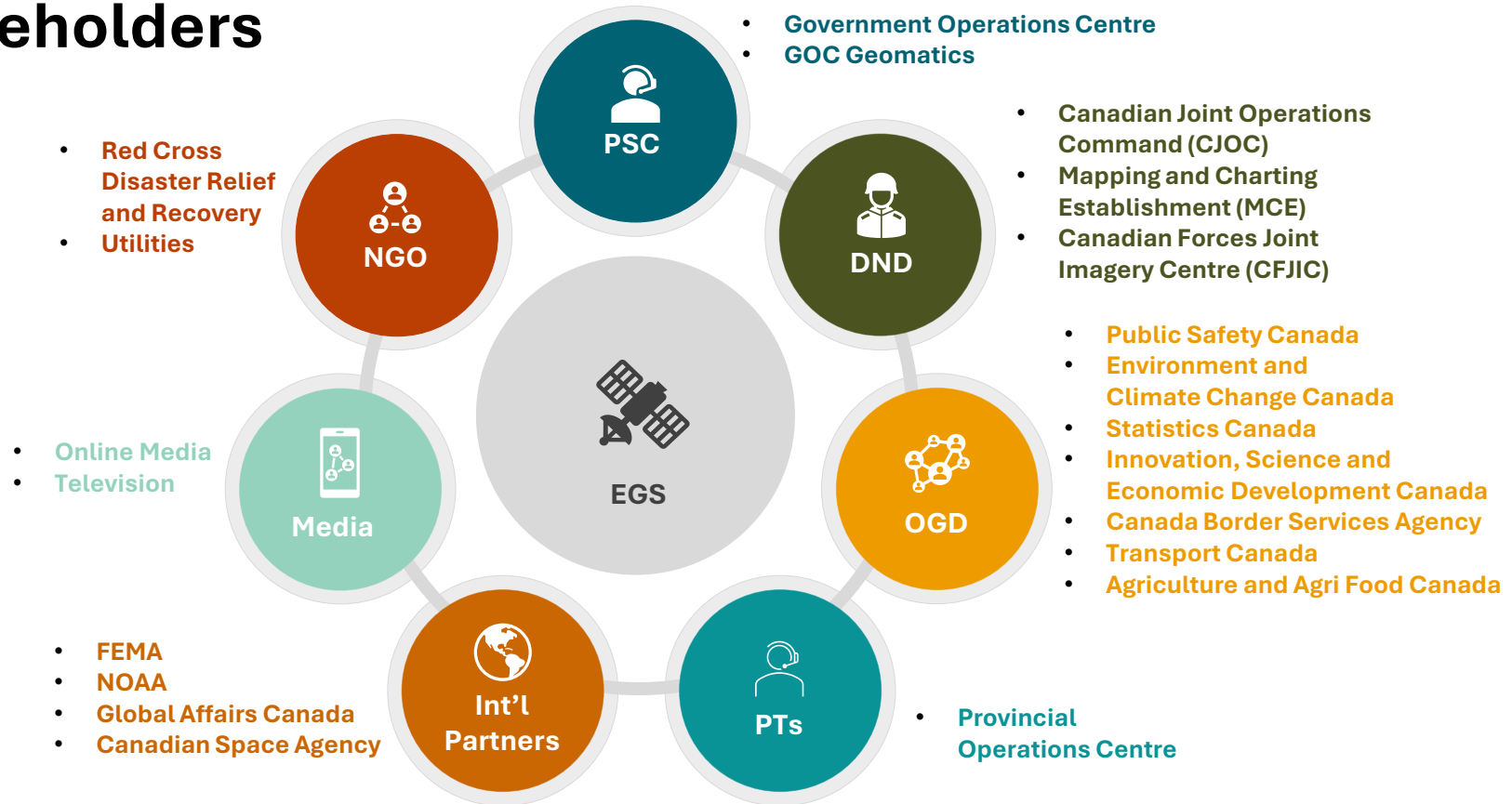
6629+ Datasets 40+ Contributors

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Support External Stakeholders



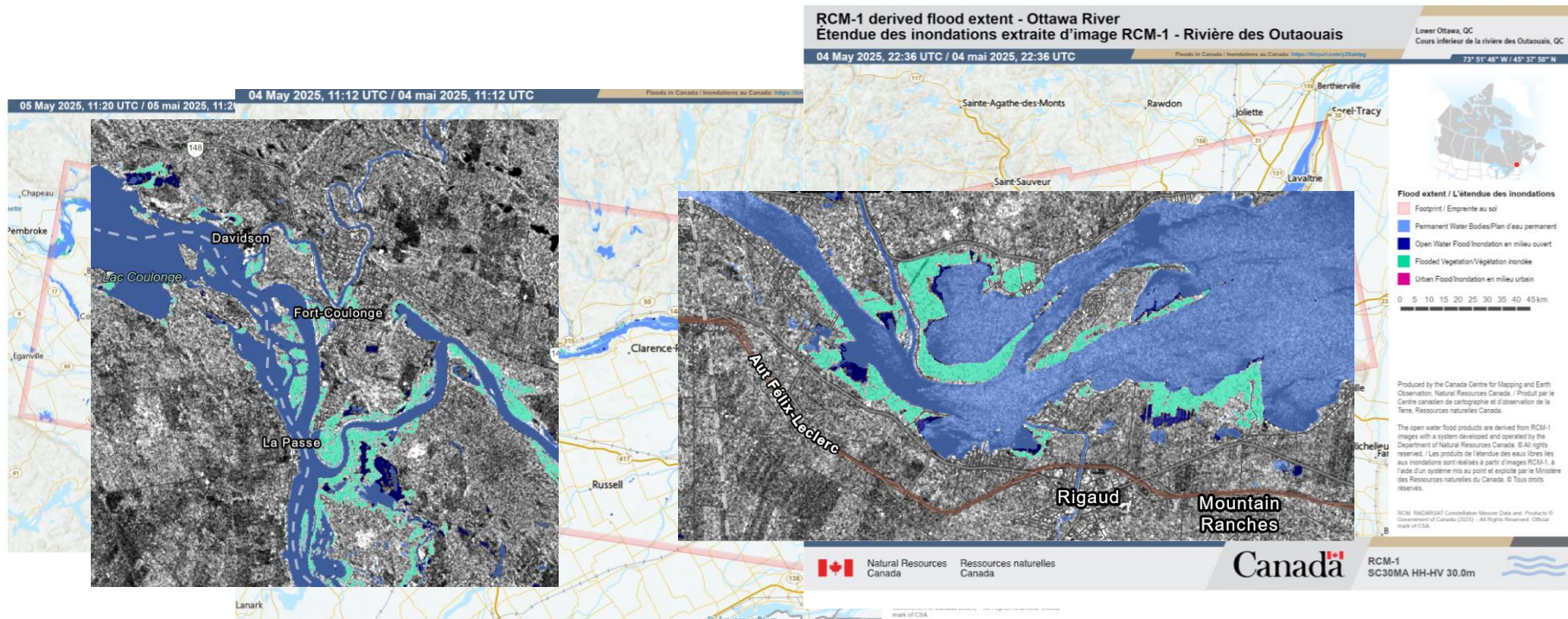


2020 Survey user feedback:

- “We were extremely pleased with the products the EGS produced. They were timely, accurate and very useful for situational awareness which helps the decision-making process. This is a great service to Canadians and deserves greater awareness for its usefulness.”
- “The files you provided were very useful. They allowed us to make more efficient, faster and accurate assessments and decisions. Combined with other sources of info, your products allowed us to use less resources. They helped us make decisions for large regions without having to directly deploy ministry staff. Overall, thank you for your help!”

Satellite Earth Observation in Action

Ottawa River Flood Monitoring, May 2025



Satellite Earth Observation in Action

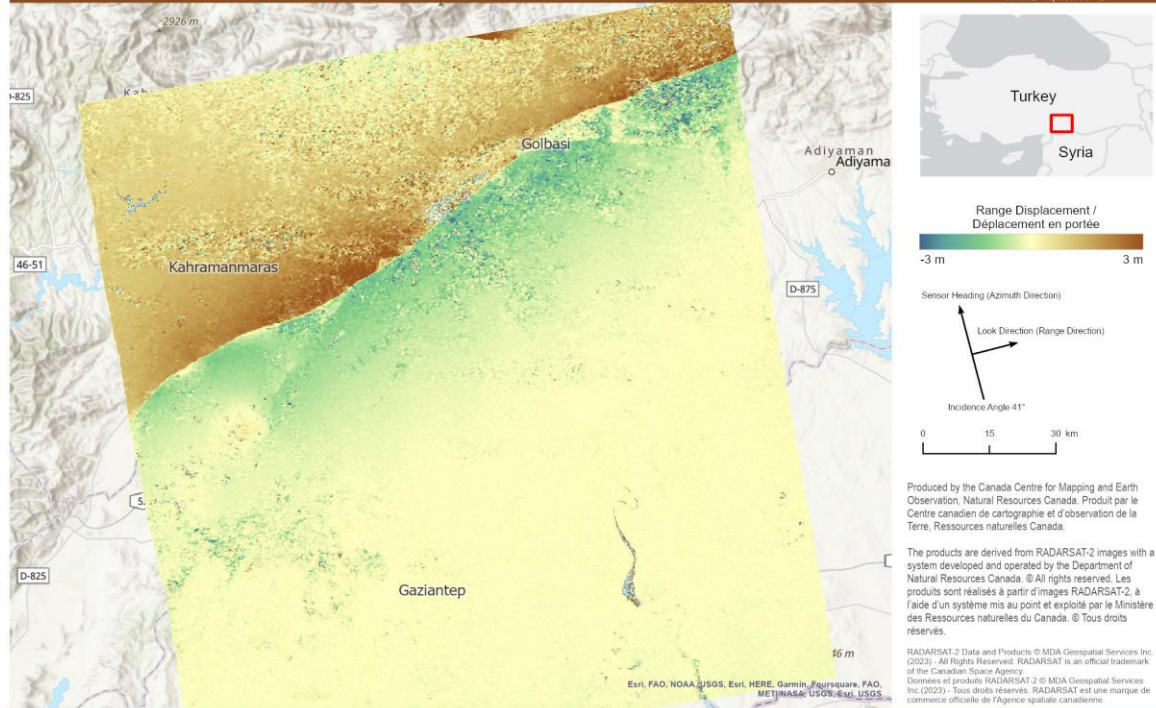
Earthquake Monitoring



Source: CNN

Turkey Earthquake: across track displacement using pixel tracking from RADARSAT-2 imagery
Tremblement de terre en Turquie : déplacement transversal par suivi de pixels à partir de l'imagerie RADARSAT-2

2023-01-14 to à 2023-02-07 15:29 UTC



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RADARSAT-2
XF0W3 HH 5m ASC



Satellite Earth Observation in Action

Volcano Monitoring



Source: CNN

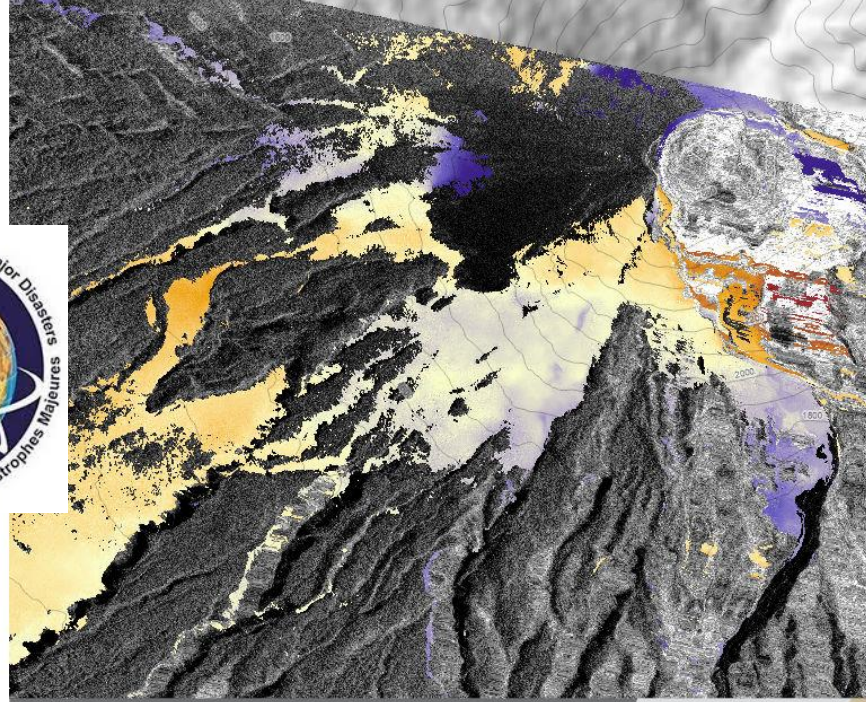


RCM-derived line of sight deformation - Mount Merapi
Déformation de la ligne de visée dérivée de la MCR - Merapi

2020-11-12 to 2020-11-16 22:25 UTC

Mount Merapi, Indonesia
Merapi, Indonésie

110°26'41"E / 7°32'27"S



Line of sight deformation
Déformation de la ligne de visée

5 cm
-5 cm

Elevation contours (SRTM)

100 m

Incident Angle: 23.4°
Look Direction
RCM Heading

0 250 500 750 1,000 m

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.

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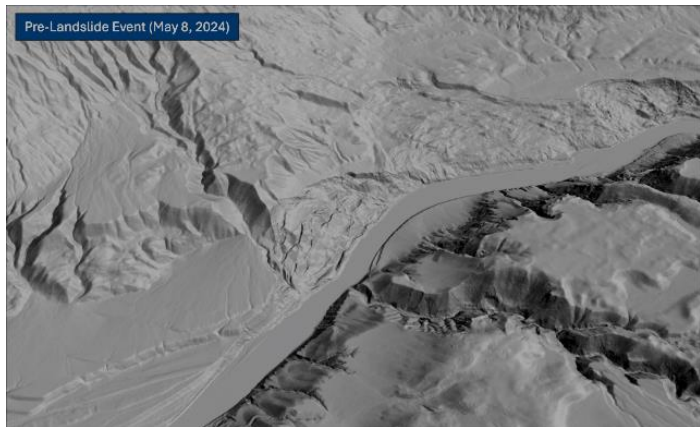
RCM
FSL5 DSC - 3x1m



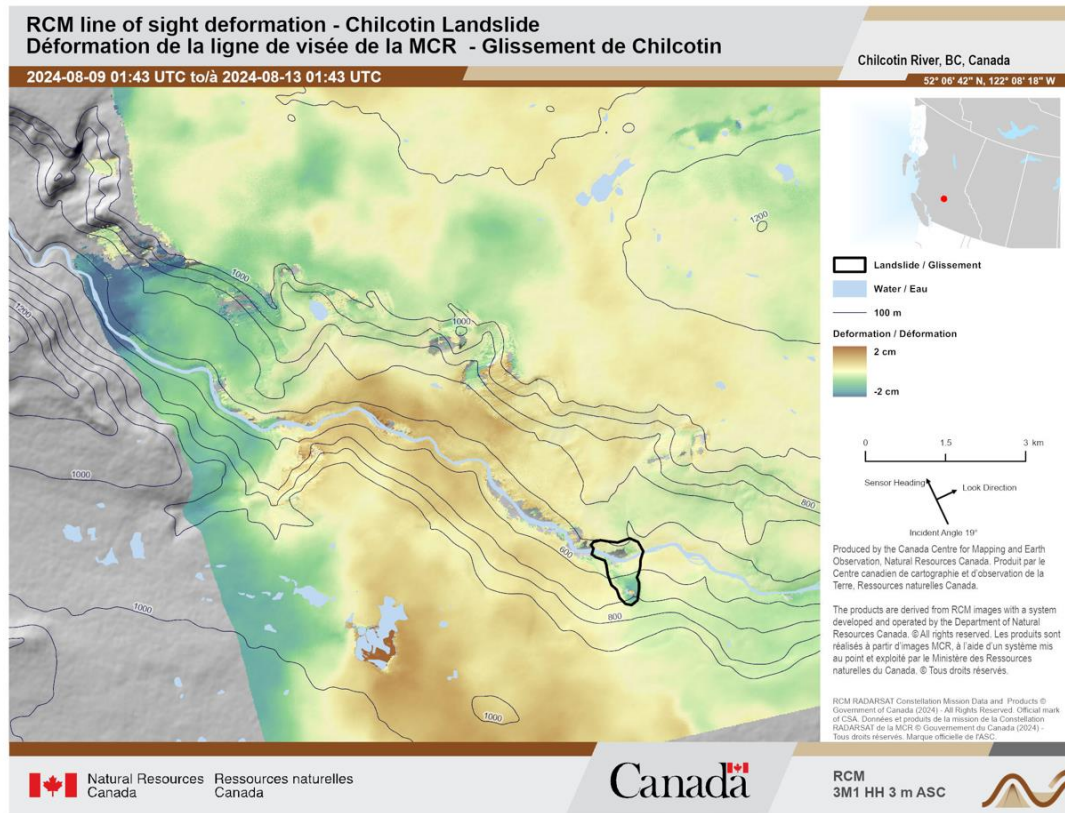
Satellite Earth Observation in Action

Slope stability assessment

2024 Chilcotin River landslide



Source: Emergency Info British Columbia



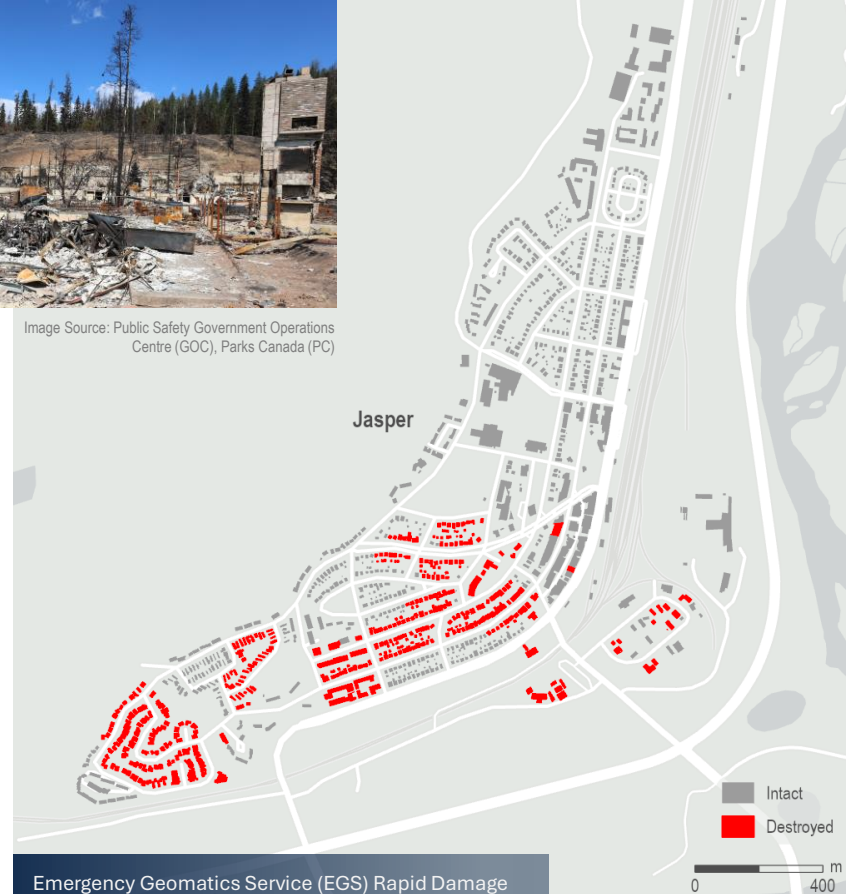
Future R&D Directions

Development of a rapid damage assessment method from SAR imagery

- Jasper 2024: RCM's polarimetric capabilities allowed EGS to distinguish between destroyed and intact structures.
- Capella's high-resolution radar validated RCM's imagery interpretation.
- An optical image, captured eight days post-wildfire, visually confirmed the results.



Image Source: Public Safety Government Operations Centre (GOC), Parks Canada (PC)



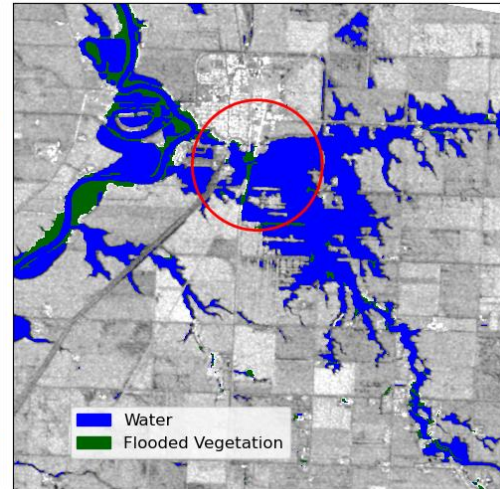
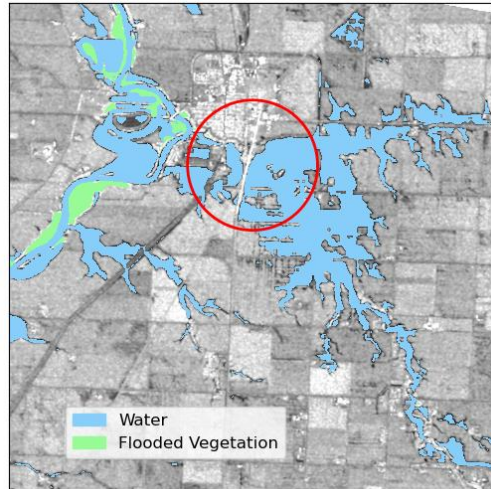
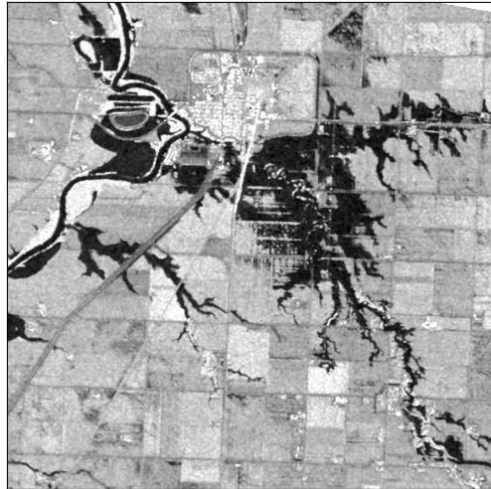
Emergency Geomatics Service (EGS) Rapid Damage Assessment (red indicates destroyed)

Geo AI for flood mapping



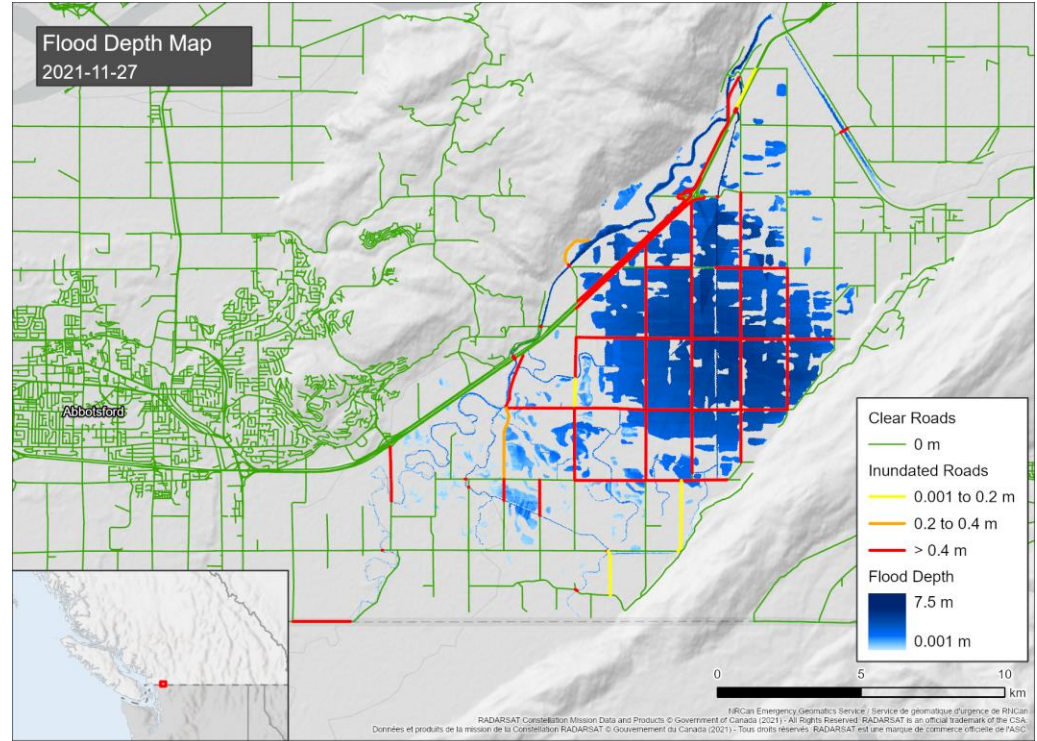
AI and machine learning are speeding up Earth observation data analysis, deep learning models can reduce the flood mapping processing time by 80%.

It accelerates processes like flood forecasting and post-disaster assessments, reducing the time needed from weeks to hours or minutes, enabling quicker, more accurate decisions.



Flood depth mapping

Thanks to investments in Flood Hazards Identification Mapping Program, it should be possible to map flood depth operationally across most of Canada



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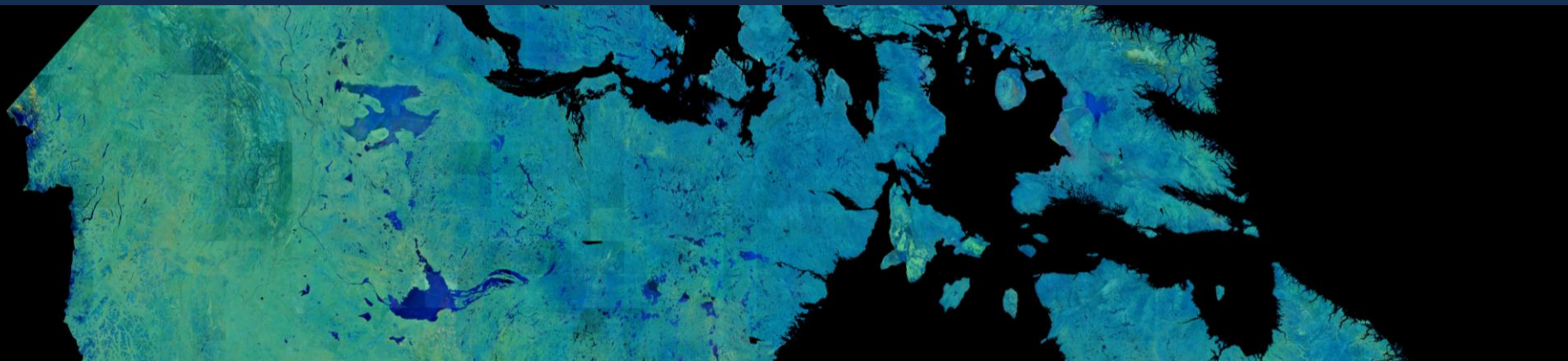
Final Thoughts



- The EGS emergency mapping services can be requested via a request for federal assistance transmitted to your regional Public Safety Canada Office
- CCMEQ provides a wide range of expertise, from satellite receiving stations to near-real-time hazards mapping, imagery archiving, on demand InSAR processing and GeoAI research and development capacity
- We continues to invest in the development of its monitoring capacities to better support its various clients in response to natural disasters

Thank you / merci

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