



Natural Resources
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AI-Driven On-Demand Mapping in Canada

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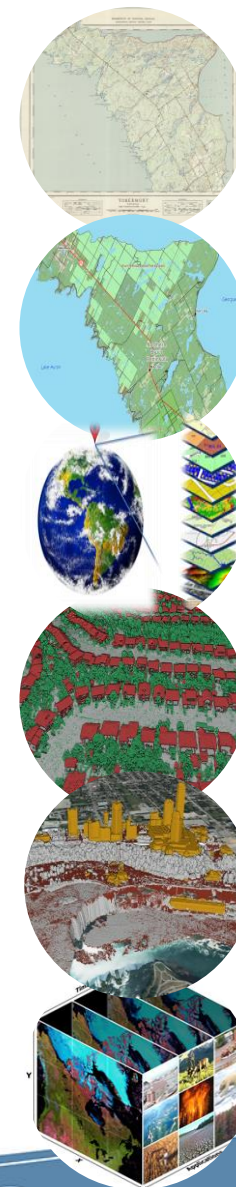
An Evolving Mapping Landscape

Canada strives to stay at the leading edge of innovative geospatial technologies, to support:

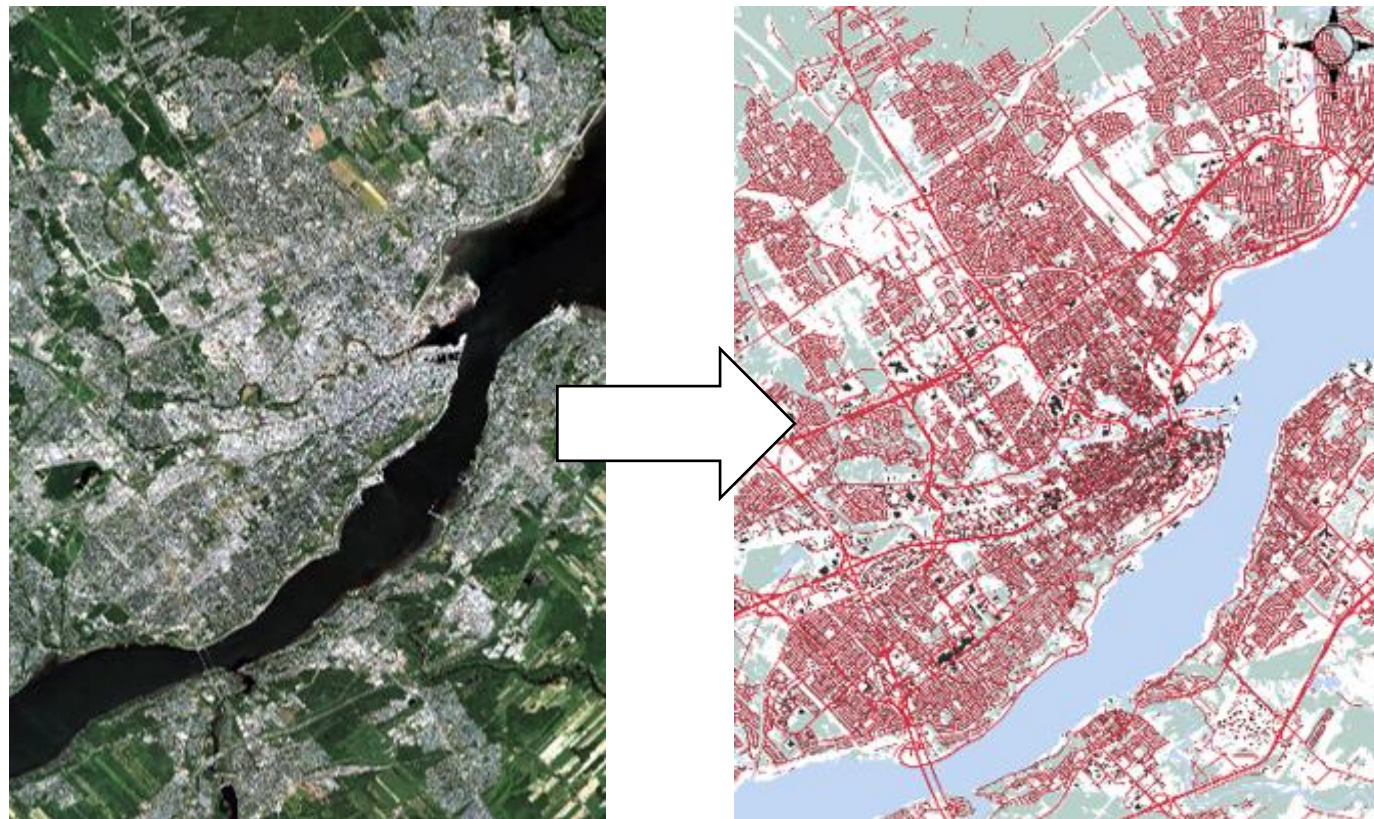
- A vast and varied geography
- Sustainable natural resource development
- Climate change adaptation
- Natural hazards and emergency response

Canada's NMSA – the Canada Centre for Mapping and Earth Observation - adapting to rapidly shifting demands

- From national coverages updated every 10 – 25 years
- To near-instantaneous mapping of important places at important times



Responding to this growing national demand for timely geospatial data
on an **issue-driven basis**...



...CCMEO is meeting the challenge with **AI-enabled mapping**



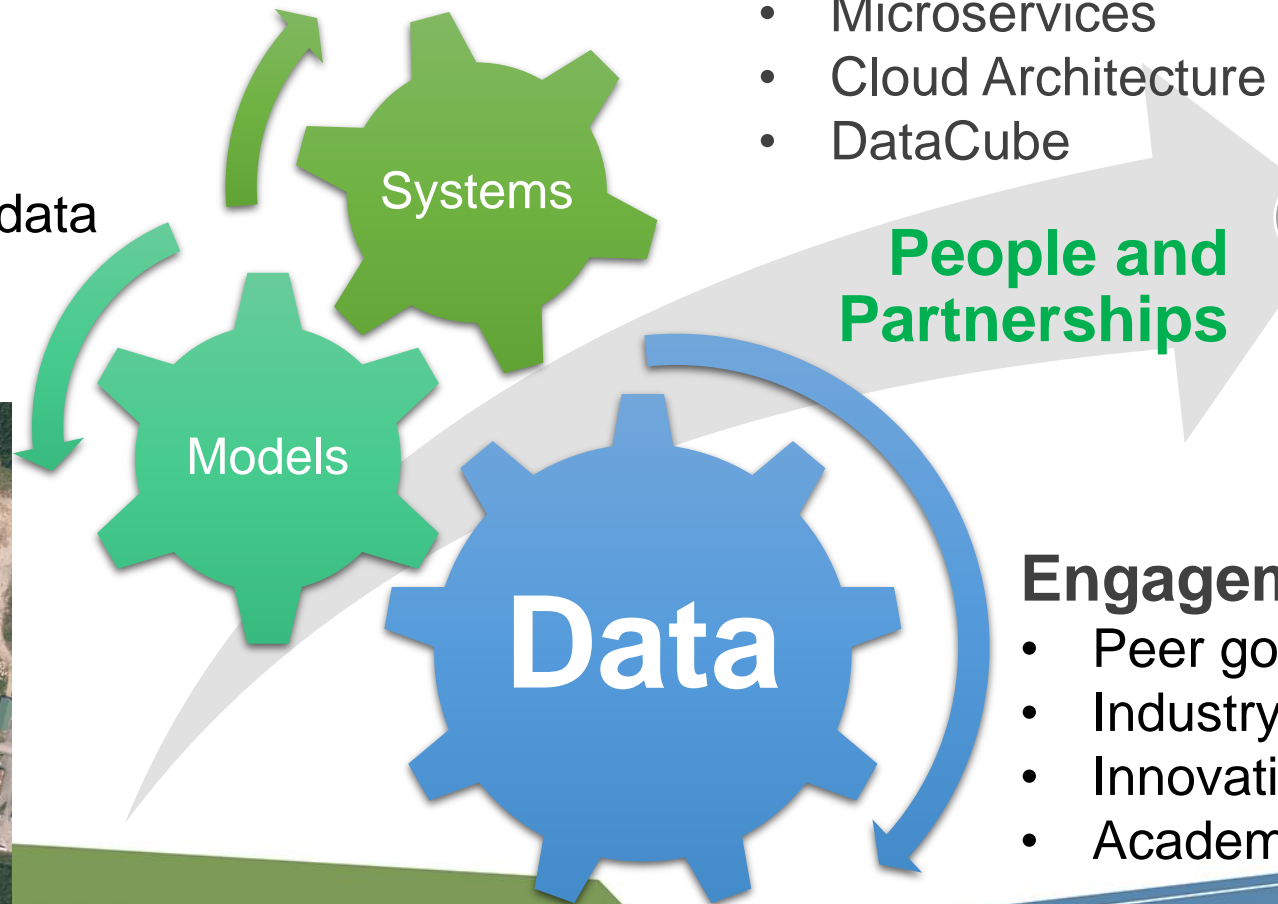
Several Years of Significant Strategic Investments

Expertise:

- Data scientists (AI modelling)
- Developers

Data:

- Decades of mission data
- New optical imagery
- Historical air photo



Technology

- High-performance computing
- Microservices
- Cloud Architecture
- DataCube

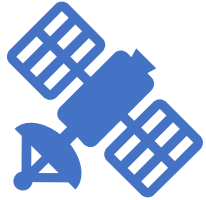


Engagement:

- Peer governments
- Industry
- Innovation accelerators
- Academia

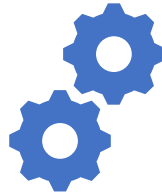


Raw Data to Analysis-Ready Information... In Minutes



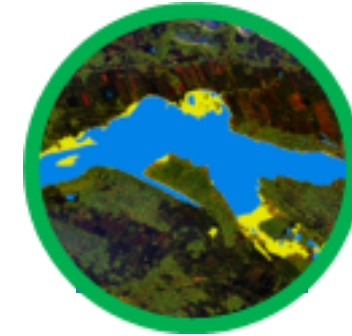
Inputs

- High-Resolution Imagery
- Historical air photos
- Satellite/radar imagery
- LiDAR data
- Vintage (paper) maps



AI as Service

- On-demand mapping
- Automated, fast and scalable
- Repeatable and adaptable
- High quality truth data in various contextual settings
- Highly adaptable training data



Outputs

- Map features (roads, rivers, lakes, buildings, vegetation)
- Improved AI models
- Change detection
- Time series



GeoAI. Nimble. Rapid. On-Demand.

	Old Paradigm (NTDB)	New Paradigm (GeoAI)
Time per NTS (820 km²)	4 to 8 months	Image delivery from provider = 2-3 days Processing, extraction and validation = 4-5 hours
Classes extracted	93	4
Maximum Resolution	4 m	30 cm
EO Data Availability	Low	High
Process	Define specifications, issue call, issue contracts, inspect work, ...	Acquire imagery, process using AI, validate, publish to GEO.ca.
Operations	Internal: Image acquisition External: Extraction, value added products	External: Image acquisition Internal: Extraction, value added products



Use-Case: Flood Mapping

Flood Susceptibility Map



Change the level of water to simulate flood impact

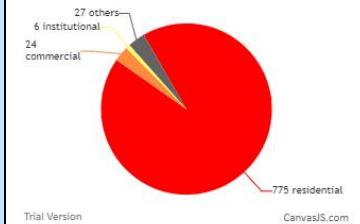
3.50

Statistics on flooded buildings*

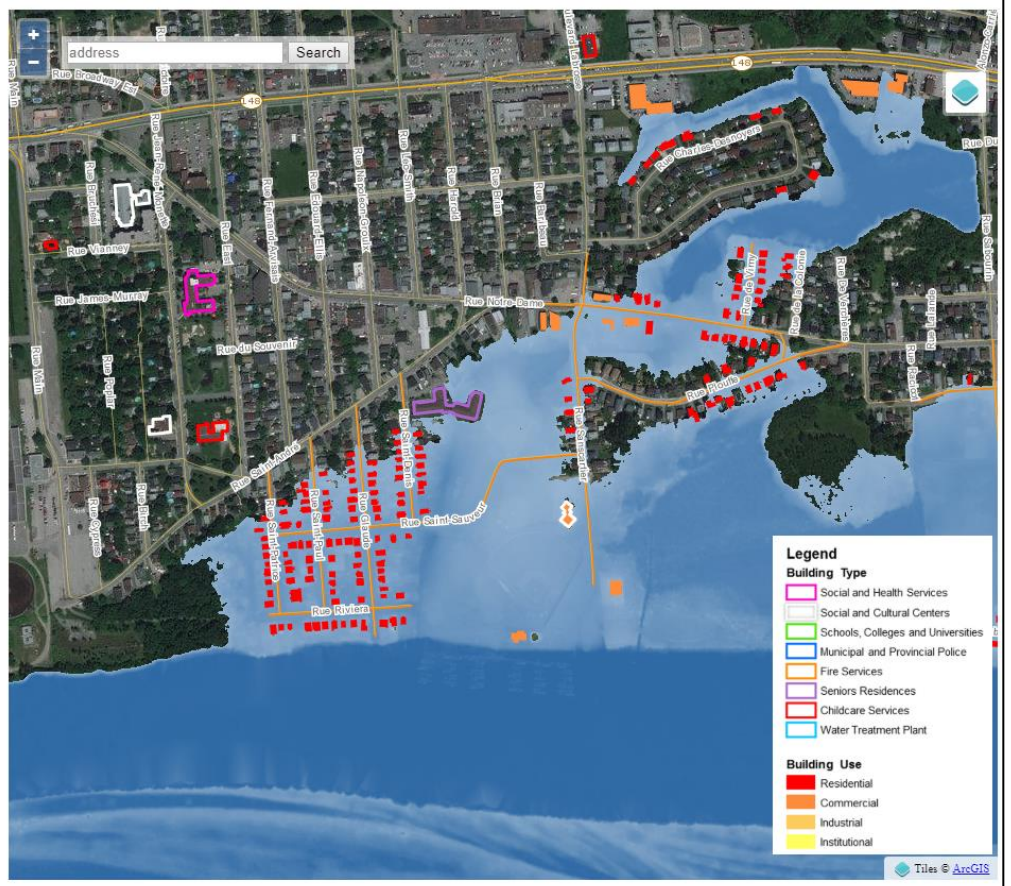
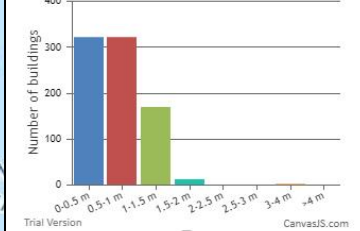
- Number of flooded buildings : 833
- Number of flooded residential units : 1385
- Number of affected persons : 3185

Export Flooded Buildings Address

Flooded buildings by use



Water depth of flooded buildings*



Flooded Buildings



Use-Case: Post-disaster change assessment

Fort McMurray, Alberta, Canada - Before and after catastrophic 2016 wildfires



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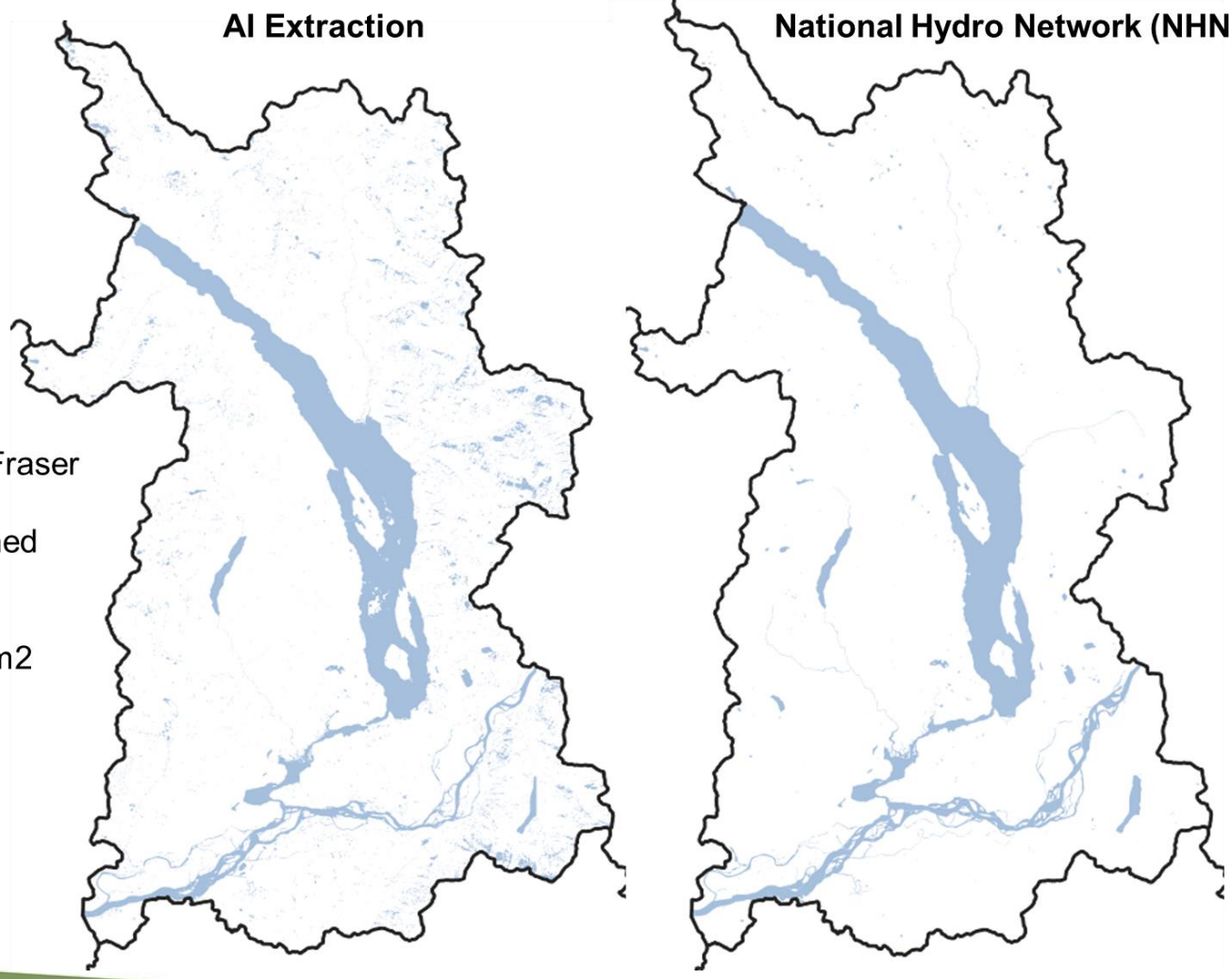
Use-Case: Environmental Change Monitoring

Deforestation
Sherbrooke - 2010 to 2020

AI Extraction

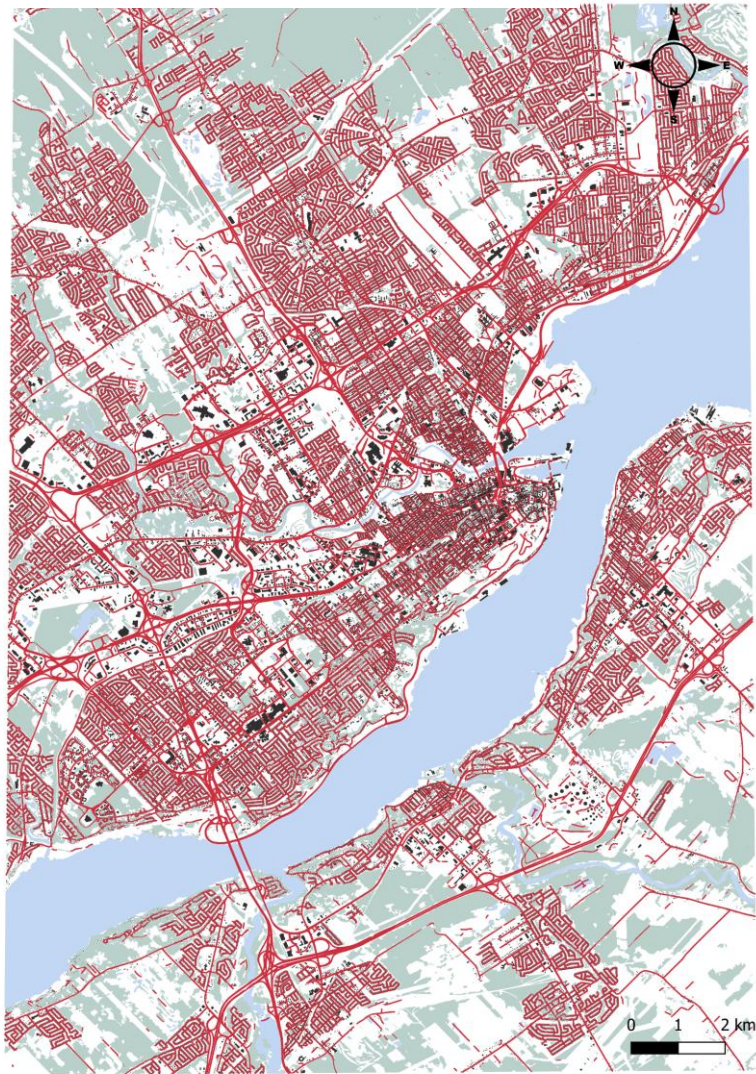
National Hydro Network (NHN)

Lower Fraser
River
watershed
(08MG)
—
3195 km²

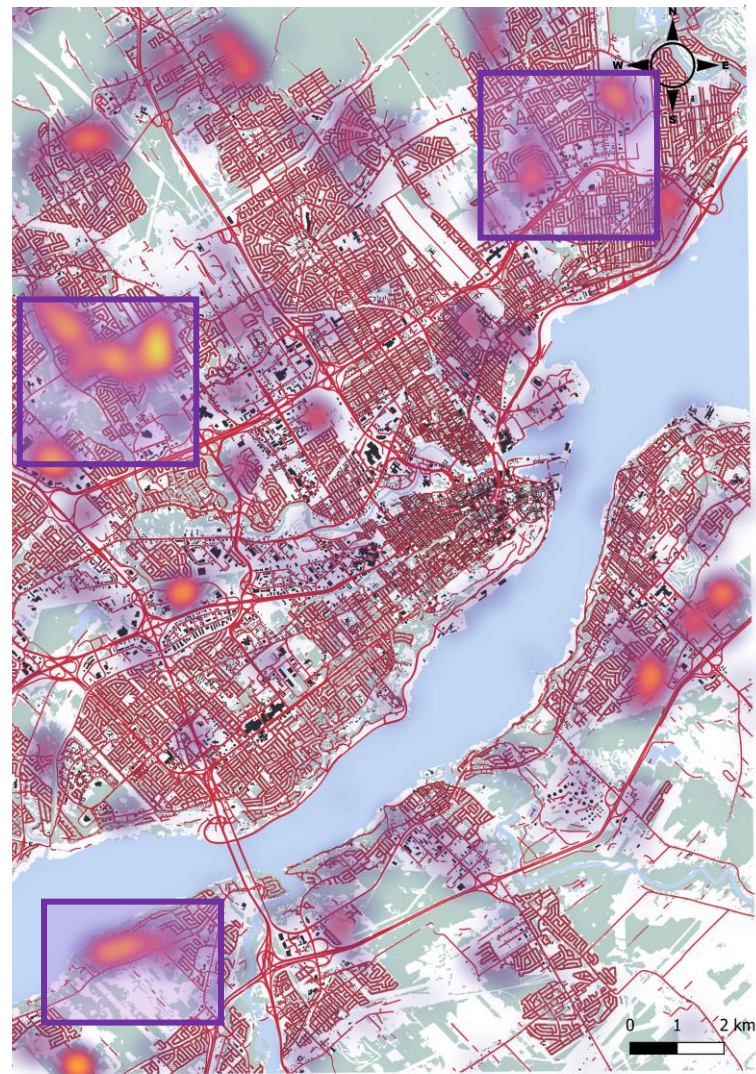


Use-Case: Urban Growth Change Detection

Extraction of Quebec City – June 25, 2006



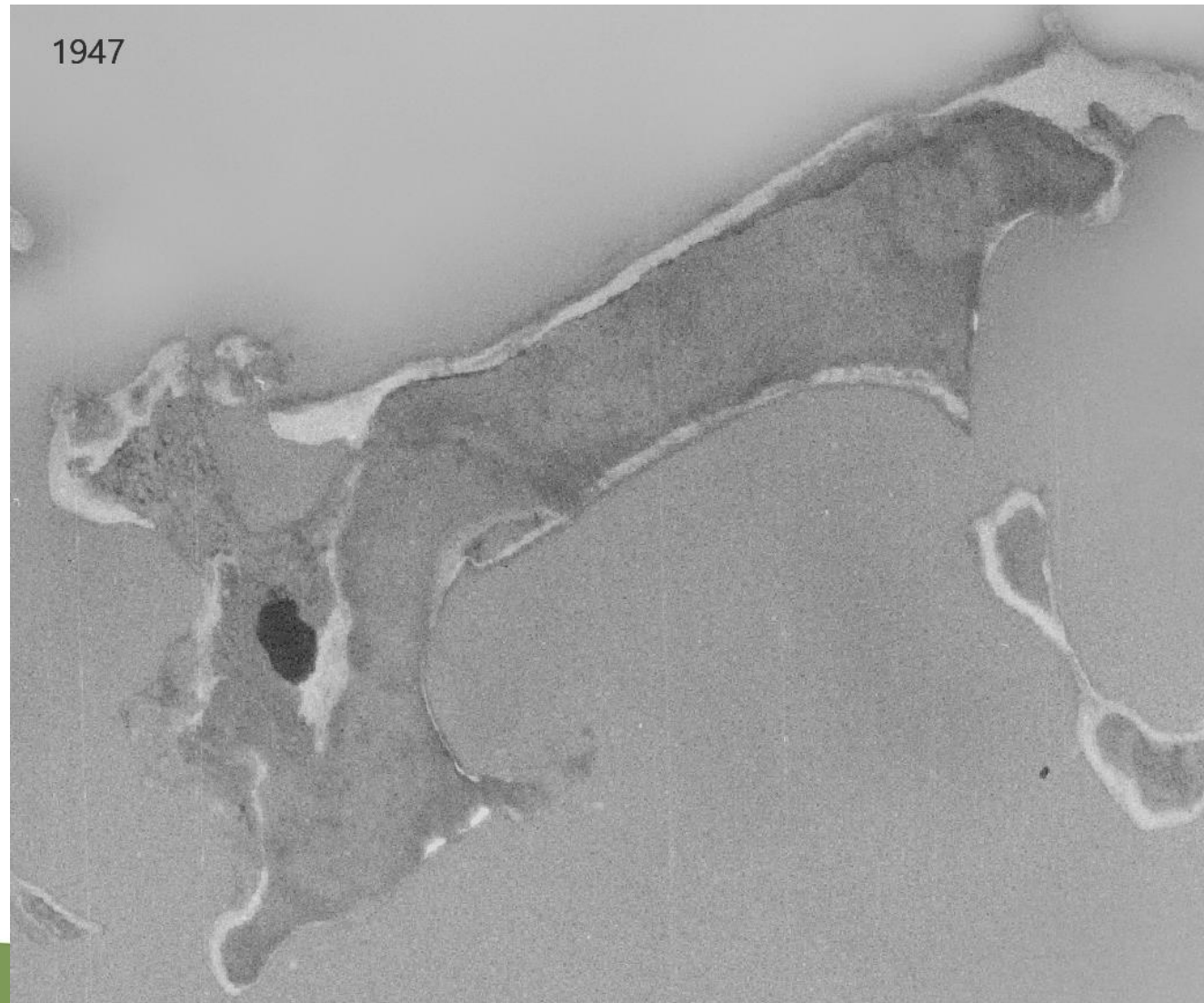
Urban Growth in Quebec City between 2006 and 2022



From 28749 to 37156 buildings detected (+ 30%)
 From 5624 to 6855 buildings detected (+ 22%)

Use-Case: Coastal Erosion Mapping

Retreat of the banks at Tuktoyaktuk Island, 1947 to 2004



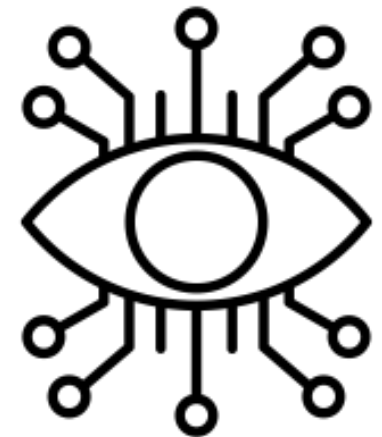
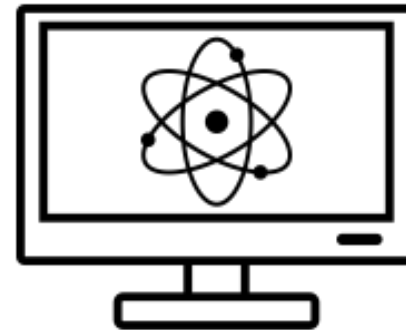
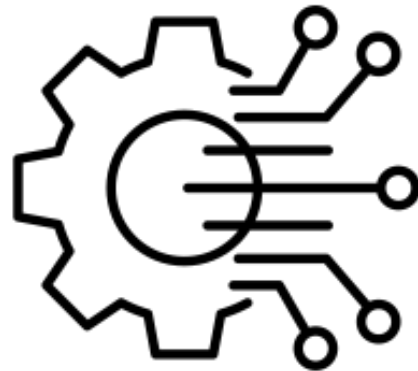
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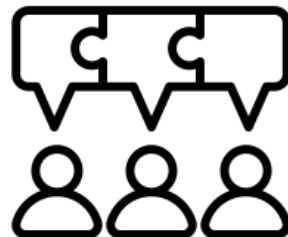
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Future Directions

- Realizing the full potential of Geo AI
- Resolving ongoing challenges
- Assuring ethical and equitable AI
- Next disruptor : quantum
- Release of GeoAI Data Series Fall 2023 on [GEO.ca](https://www.geo.ca)



Thank you – Merci!



[Alexandre Beaulieu](#), Senior Director, Canada Centre for Mapping and Earth Observation (CCMEO)

Access our GeoAI code and open-source tools:

<https://github.com/NRCan/geo-deep-learning>



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