



NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

National Elevation Data Strategy

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April 5, 2017

UN-GGIM: Americas
Seminar on Geospatial Information
Santiago, Chile



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Agenda

- Introduction
- Elevation Data Strategy
- Status and Next Steps



Canada's Landmass

Canada is the 2nd largest country in the world
- 9.9 million sq km

Surrounded by 3 oceans with
202 000 km of coastline

Population over 35 million



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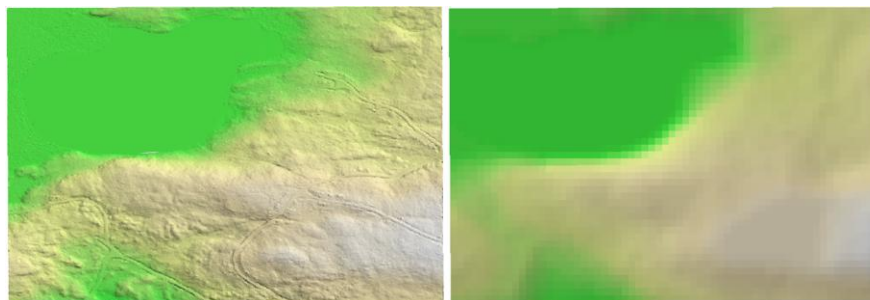
Elevation data

- Elevation data has been made openly available to Canadians as essential geographic information for many years
- Core Framework Dataset
- Opportunity for collaborative maintenance, sustainability and evolution of elevation data and services
- Revitalization of a fundamental framework data layer.



Drivers

- National elevation data are far the most popular among users.
- High-precision elevation data is critical to many domains. They are extensively used in forestry, flood risk management, transportation, infrastructure, precision farming, land and water management, and climate change.
- Canadians have demonstrated a demand for this information – 70% demand is elevation/imagery information.
- Economic value of high accurate elevation data
- Imagery and elevation will be the most important source data to update other layers (territory representation and feature extraction, basis for ortho-retification)
- Increase in demand for various resolution and accurate elevation data (such as LiDAR) and derivative products(slope maps, hillshade, etc..)

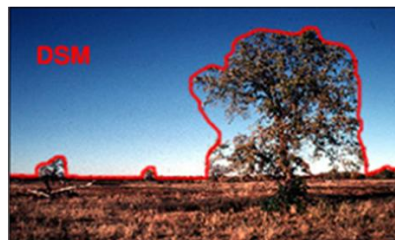


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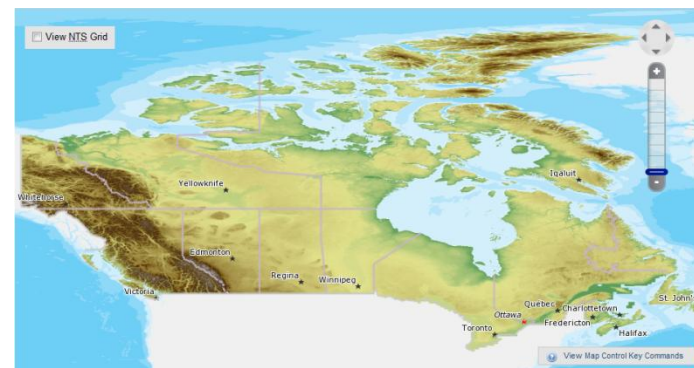
Elevation in Canada

- No centralized service and inventory for high accurate elevation data
- Digital Terrain Model
 - From the hypsographic and hydrographic elements
 - Resolution: 0,75" x 0,75" (23 m x 16-11 m)
 - Validity date: 1945-2011
 - Accuracy 90%: 2 à 50 m



Source: ArcticSDI

- Digital Surface Model
 - From Shuttle Radar Topographic Mission (SRTM)
 - South of latitude 60 degrees North
 - Resolution: 0,75" x 0,75" (23 m x 16-11 m)
 - Validity date: 2000
 - Accuracy 90%: 5 m



New Priorities

- The renewal and enhancement of national elevation data coverage has recently been identified as a priority by the Canadian Council on Geomatics and Federal Committee for Geomatics and Earth Observation.
- Natural Resources Canada is implementing an elevation data strategy in partnership with federal, provincial and territorial agencies.
- LiDAR data provide new opportunities for enhancing elevation information, products and services.

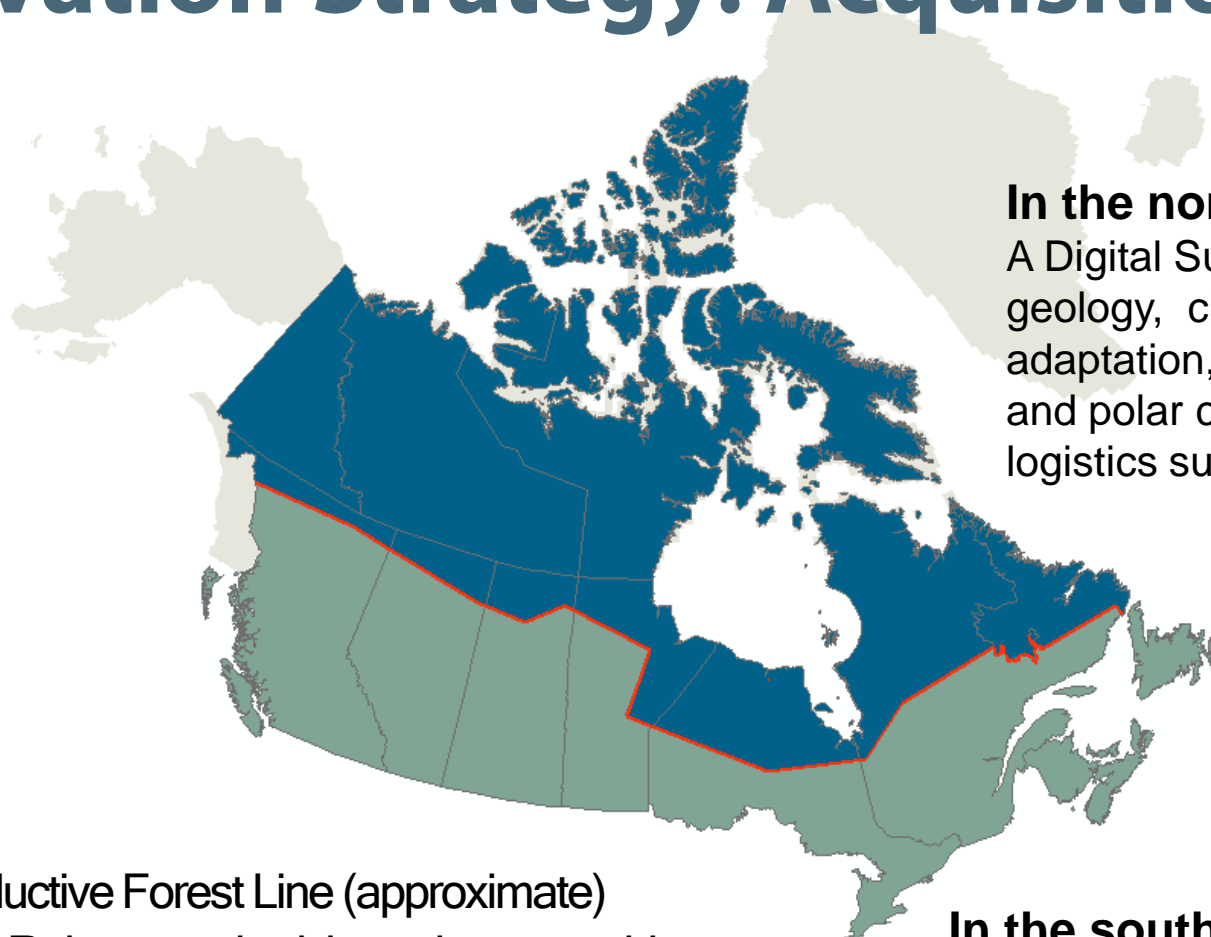


Elevation Strategy

- ◆ **Increase high resolution elevation data coverage** using appropriate sources based on needs (LiDAR/imagery).
- ◆ **Optimize past and future investments** in elevation data acquisition by promoting the release of existing data and encouraging pooled procurement for new data.
- ◆ **Improve accessibility of the data** by promoting open licensing, establishing appropriate management and dissemination systems, and availability of elevation products and services.



Elevation Strategy: Acquisition plan



In the northern part:
A Digital Surface Model for geology, climate change adaptation, geohazards and polar continental shelf logistics support

- Productive Forest Line (approximate)
- LiDAR data acquired through partnerships
- Data from auto-correlated stereo images

In the southern part:
A Point Cloud, a Digital Terrain Model and a Digital Surface Model for forest, urban, agriculture and flood mapping areas

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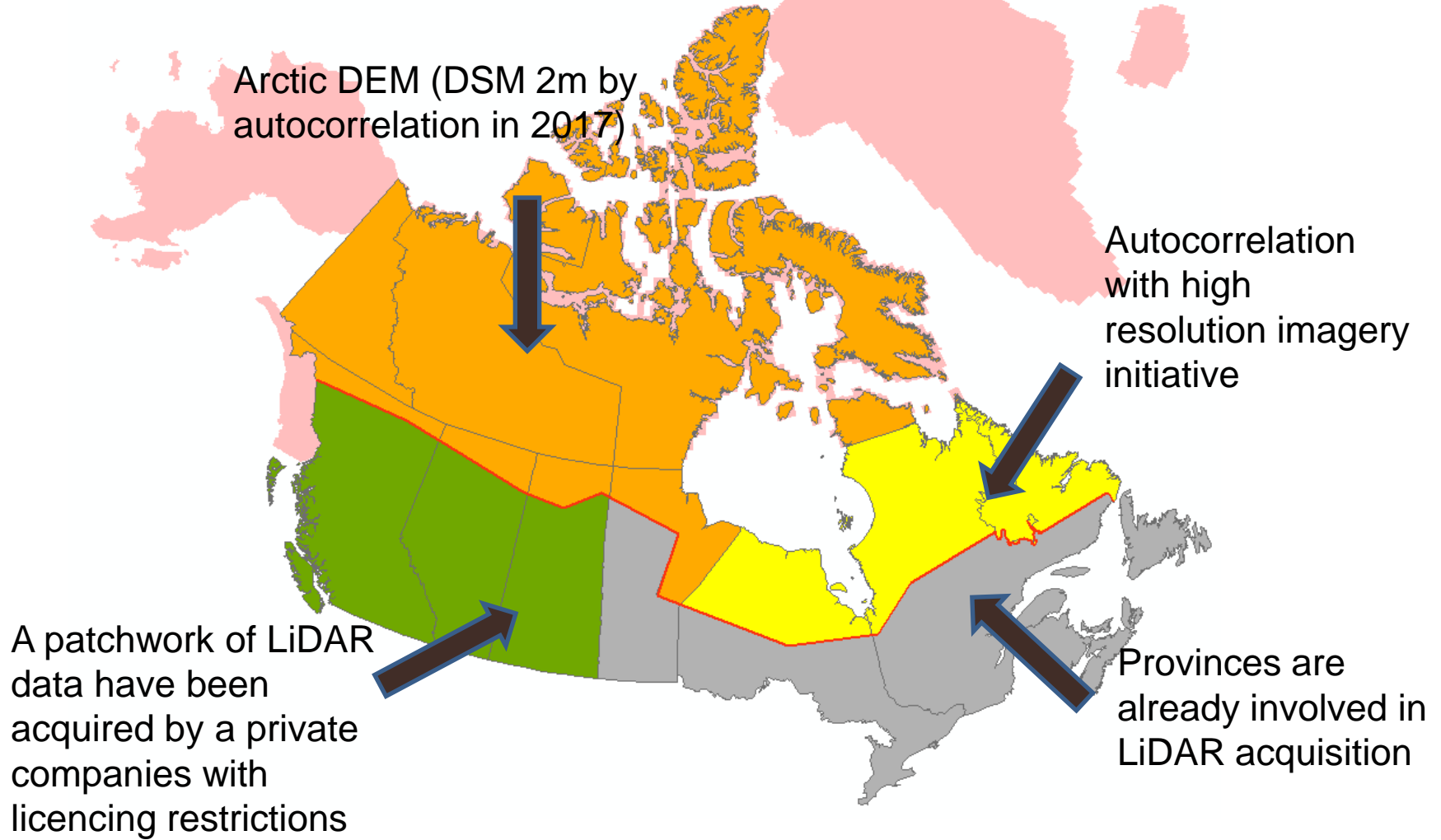


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Acquisition plan (Collaboration)



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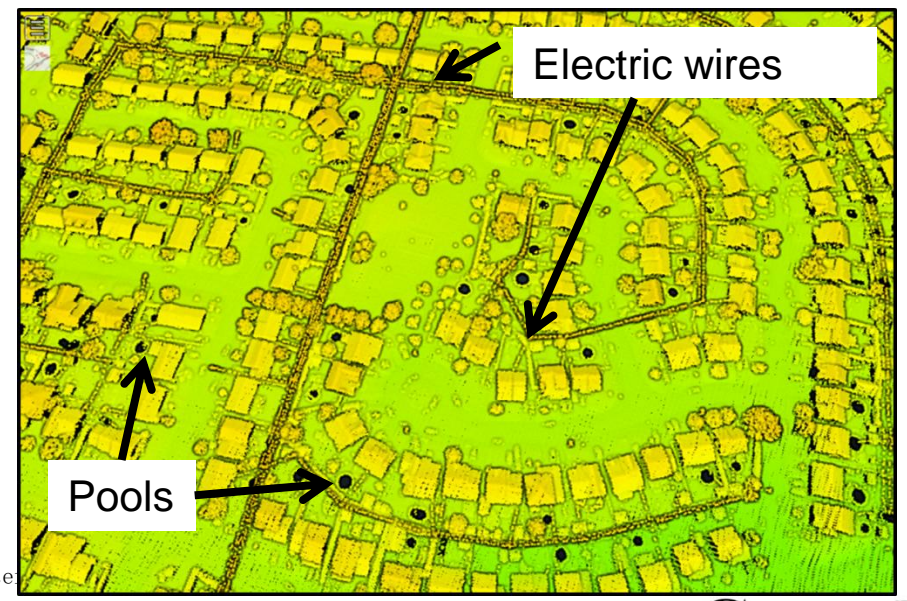
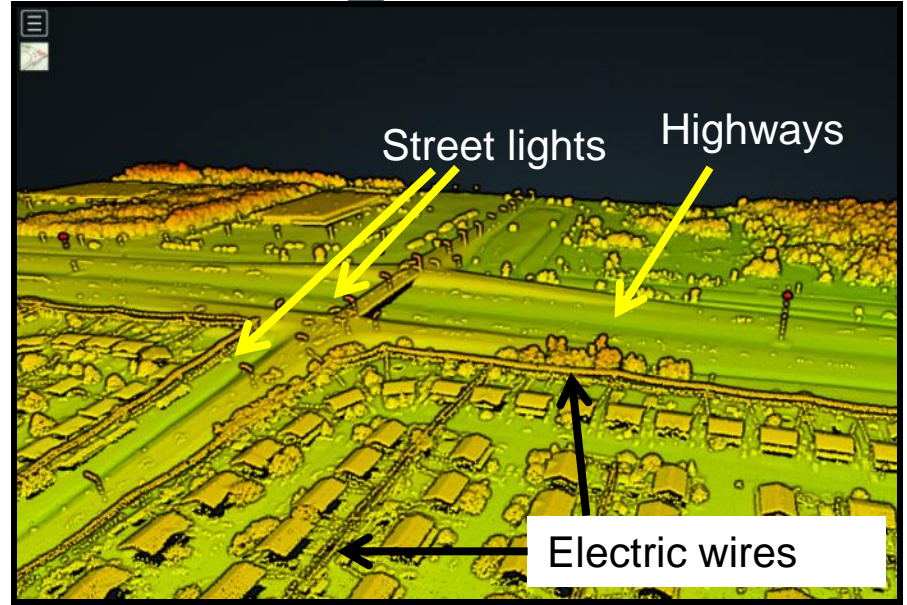
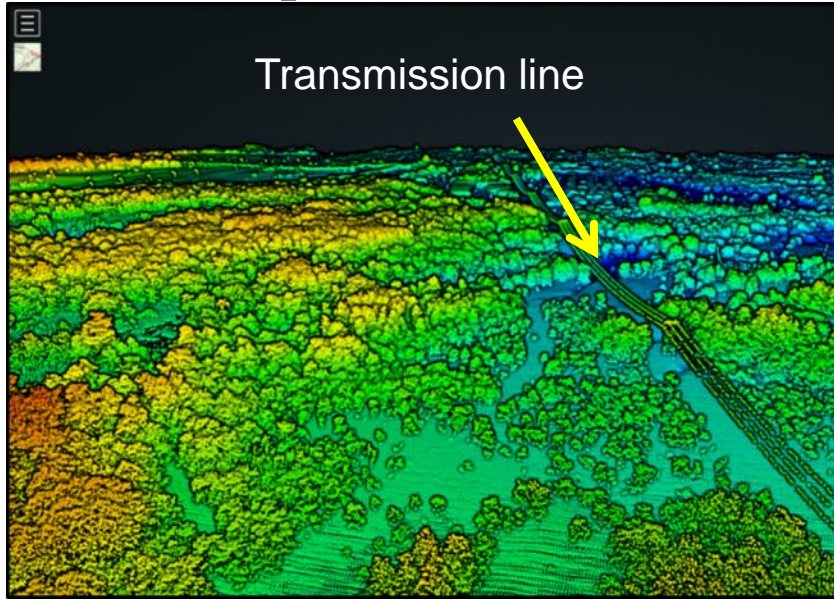


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Example Lidar (Gatineau region)

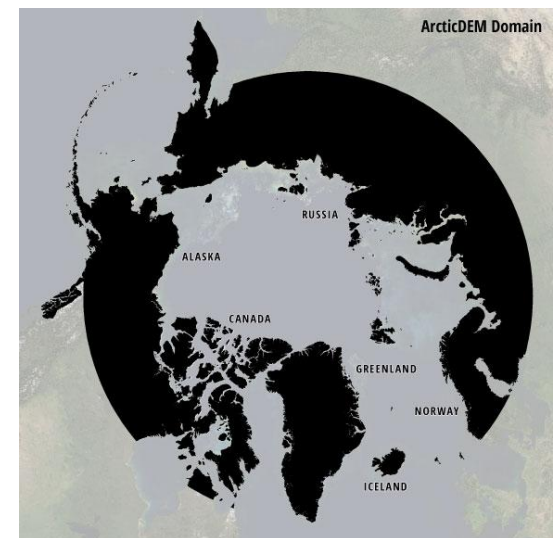


Elevation in Canada

ArcticDEM

The United States Announces New Investments to Combat Climate Change

- 2m resolution Digital Surface Model strips and a 5m mosaic (from stereoscopic Digital Globe Imagery)
- Arctic coverage (>60th parallel) and Western Canada
- By summer 2017
- In the Public Domain
- No human intervention (**seeking assistance**)
- The NGA and NSF are collaborating with the University of Minnesota's Polar Geospatial Center and, the private sector
- The Canada support the initiative (providing accurate data and feedback)



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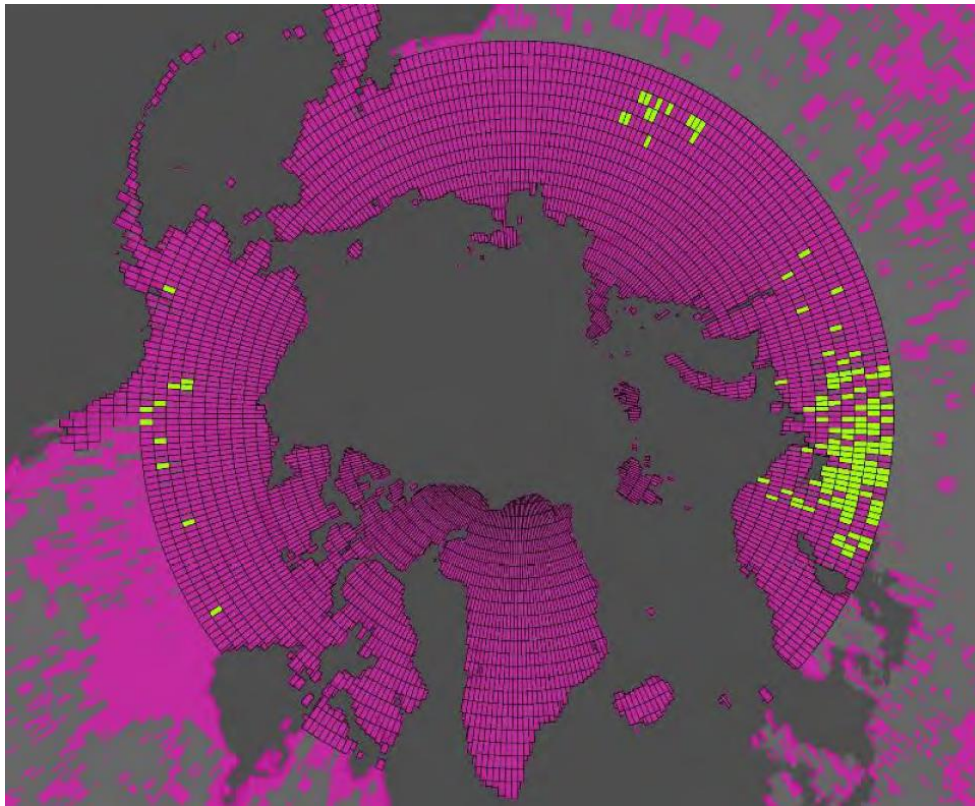
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ArcticDEM: Acquisition Status

In collaboration with the Arctic Spatial Data Infrastructure (SDI)



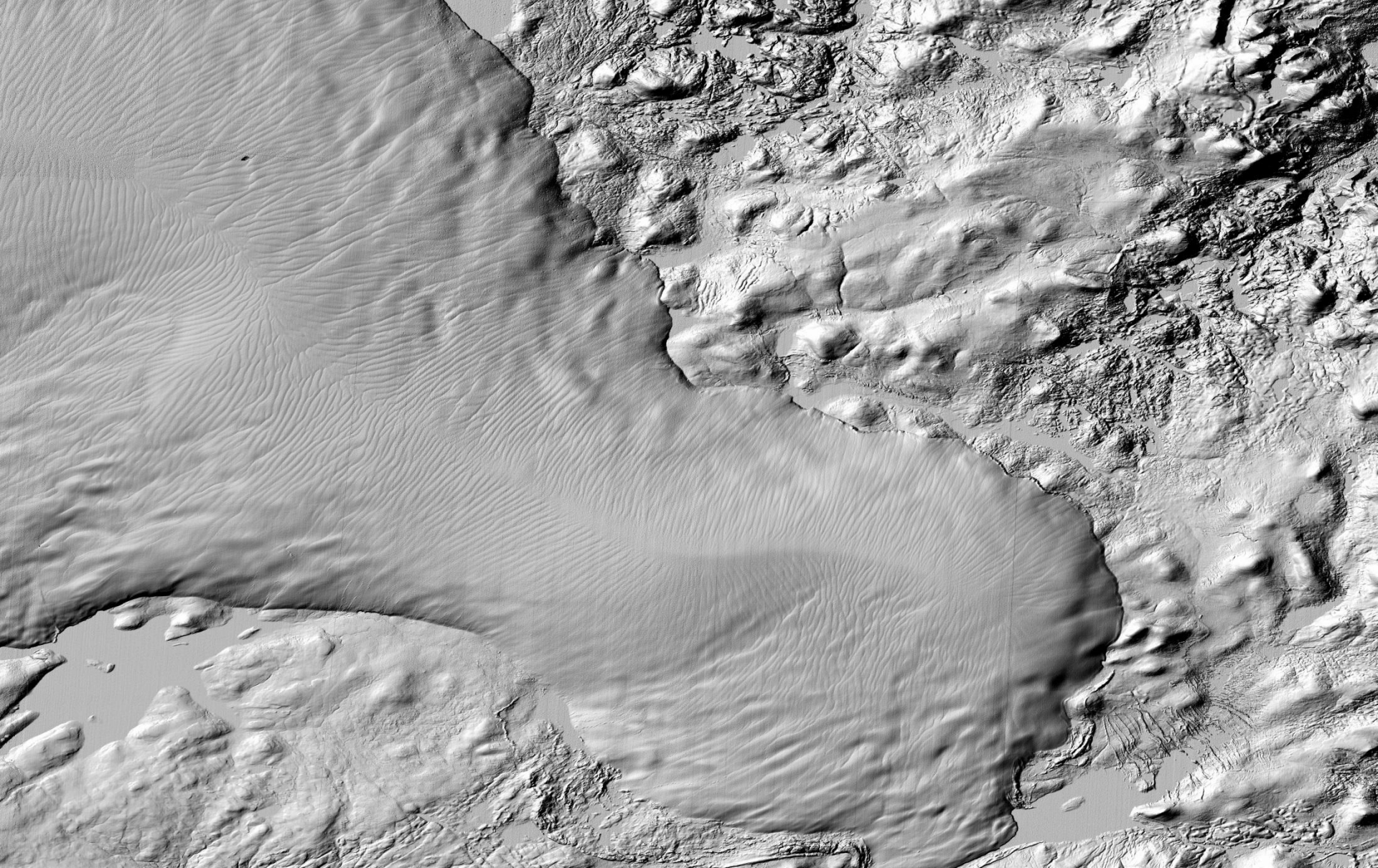
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ArcticDEM: Hillshade rendering: The Barnes Ice Cap

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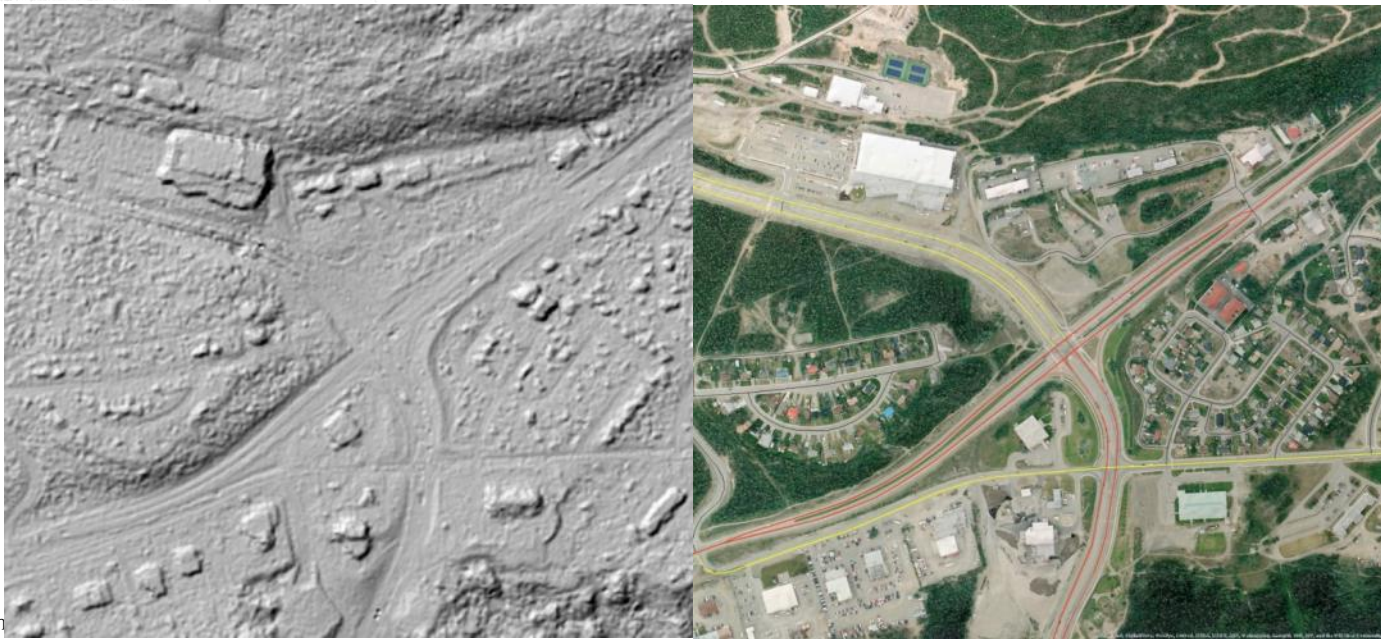
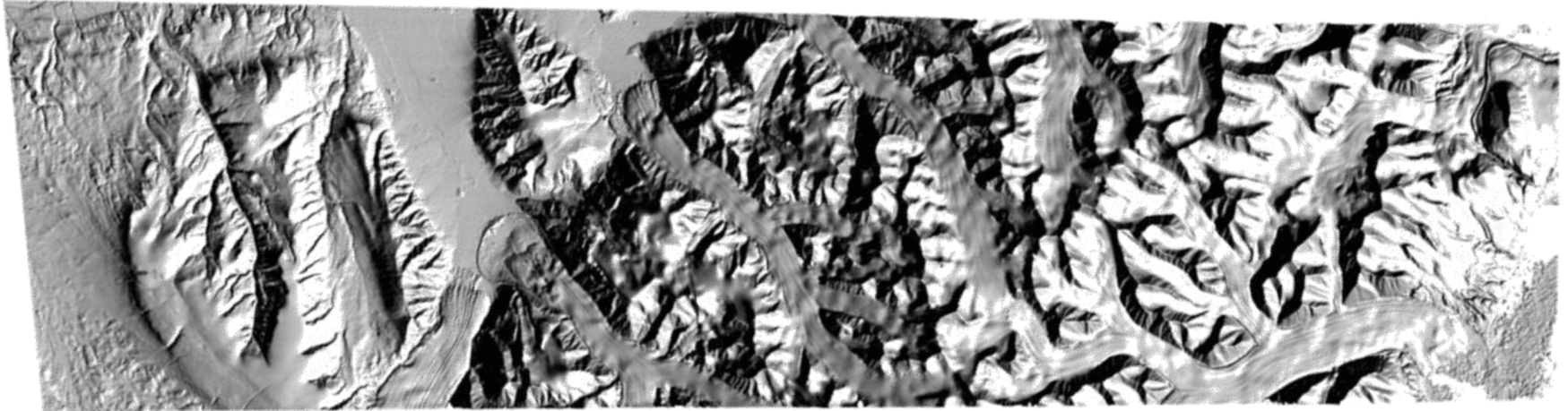
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ArcticDEM



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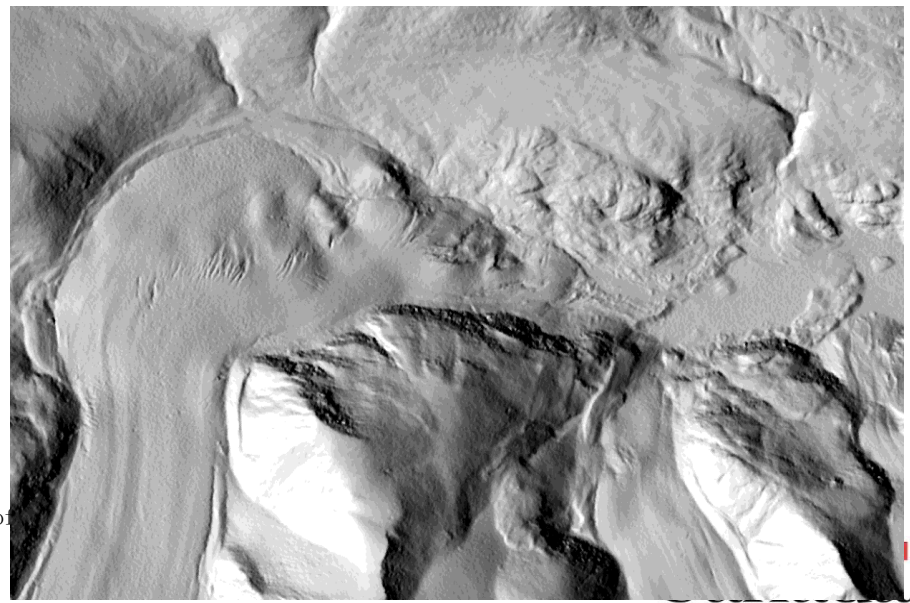
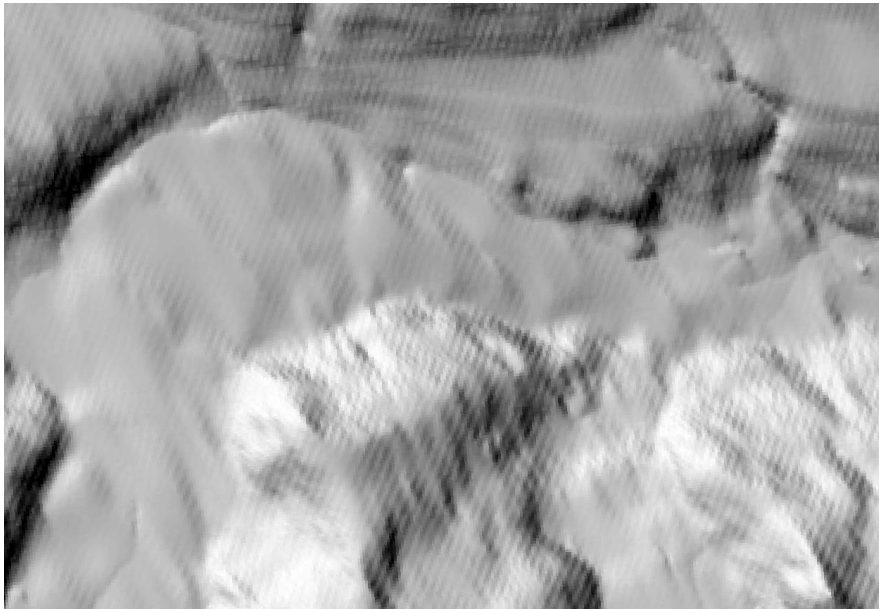
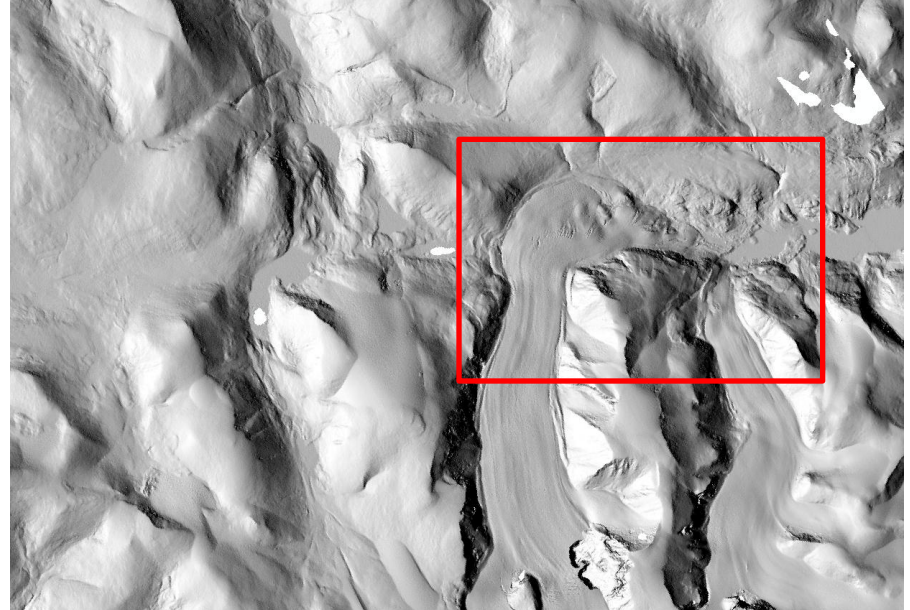
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CDEM (20m)



ArcticDEM (5m)



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New products

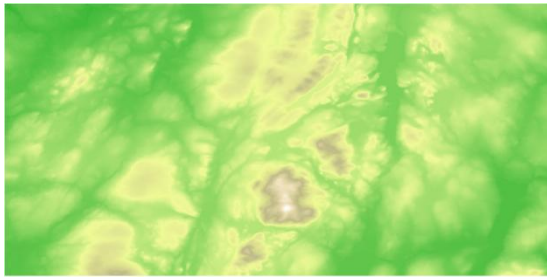
- **2m DEMs** (from 2016-2017)
 - Per project (No alignment between projects)
 - Reduce deformations (accurate data cm)
 - Need high precision
 - local needs
 - Keep the original projection (UTM)
 - 2m resolution

- **Mosaic of DEMs** (from 2017-2018)
 - Feeding web services (WMS, WCS, CZS, REST ...)
 - Multi-resolution (from 5m to 300m)
 - Pre-defined tiles and pixel alignment

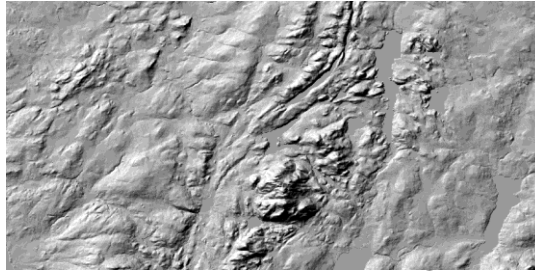
- **multi-resolution and derived products**



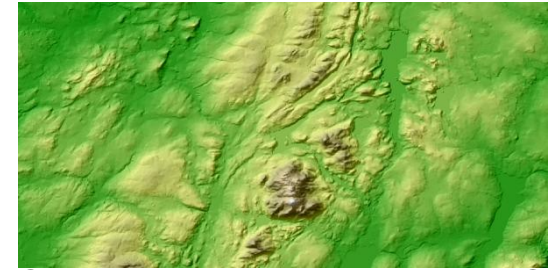
Mosaic of DEMs (5m to 300m)



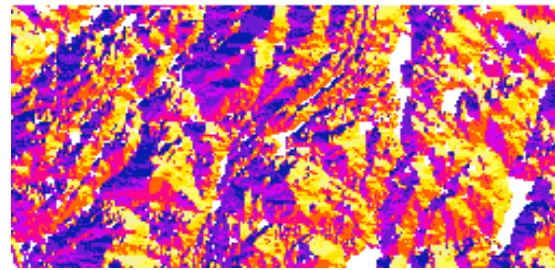
Color map by BBOX



Hillshade map by BBOX



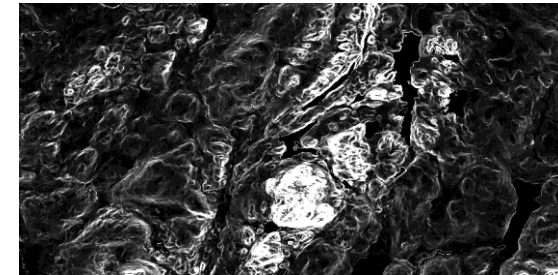
Color hillshade map by BBOX



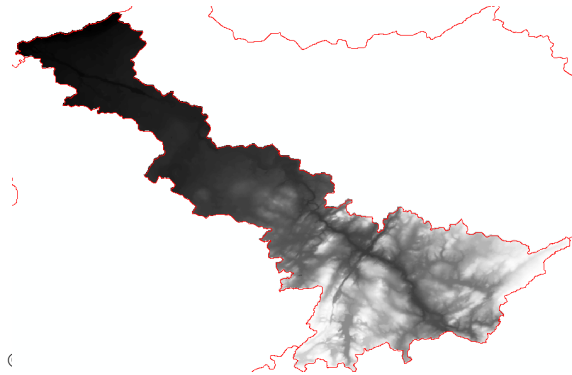
Aspect map by BBOX



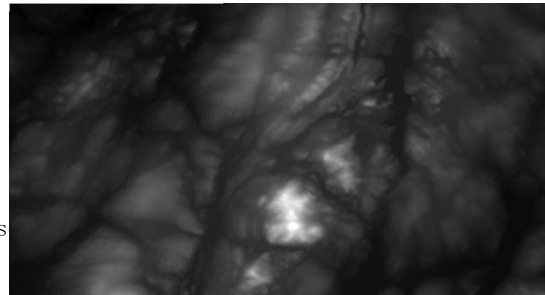
Web extractor UI



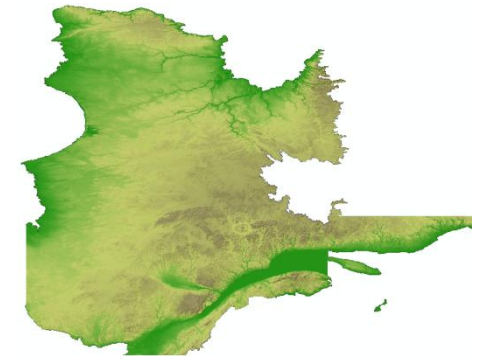
Slope by BBOX



DEM by watershed



DEM by BBOX



Color map by province

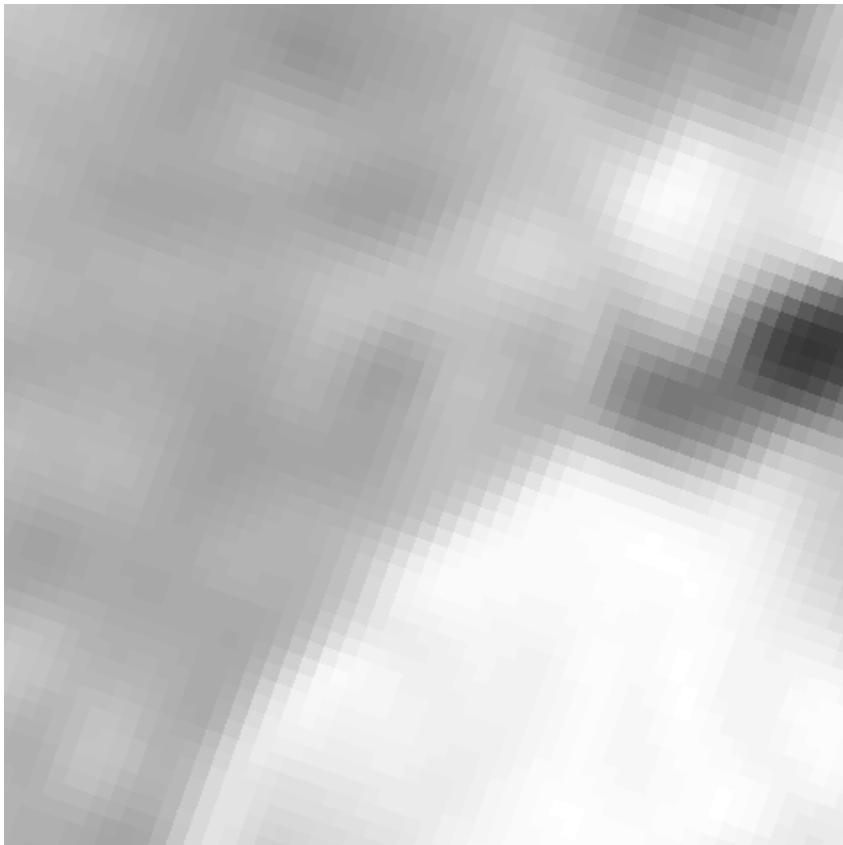


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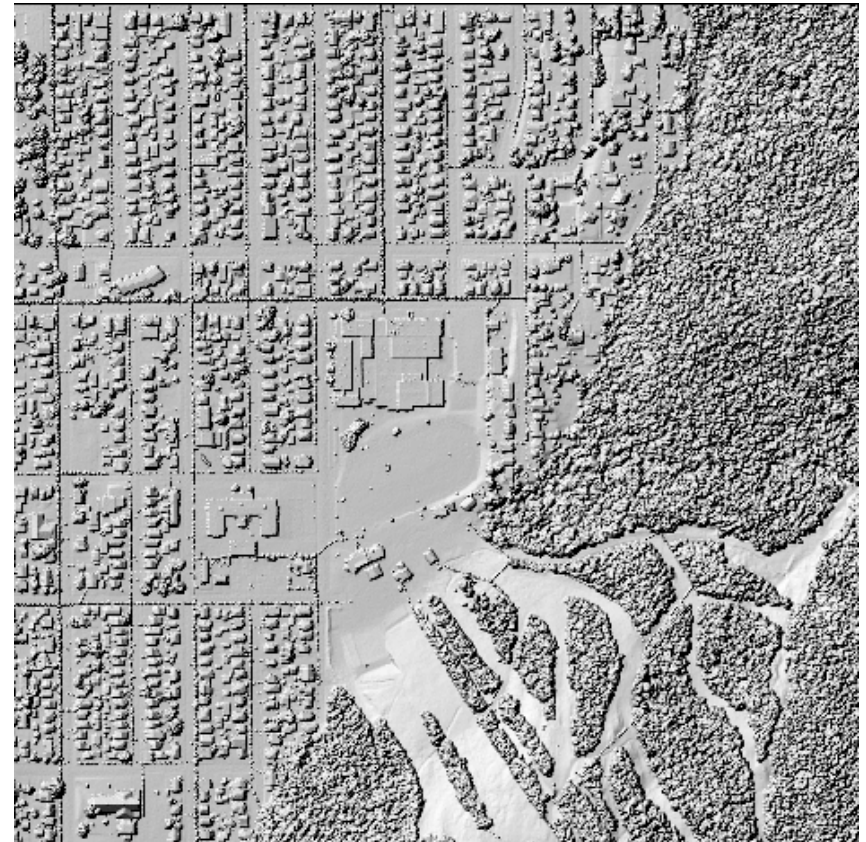
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2m DSM High resolution

CDSM (20m)



LiDAR DSM (2m)



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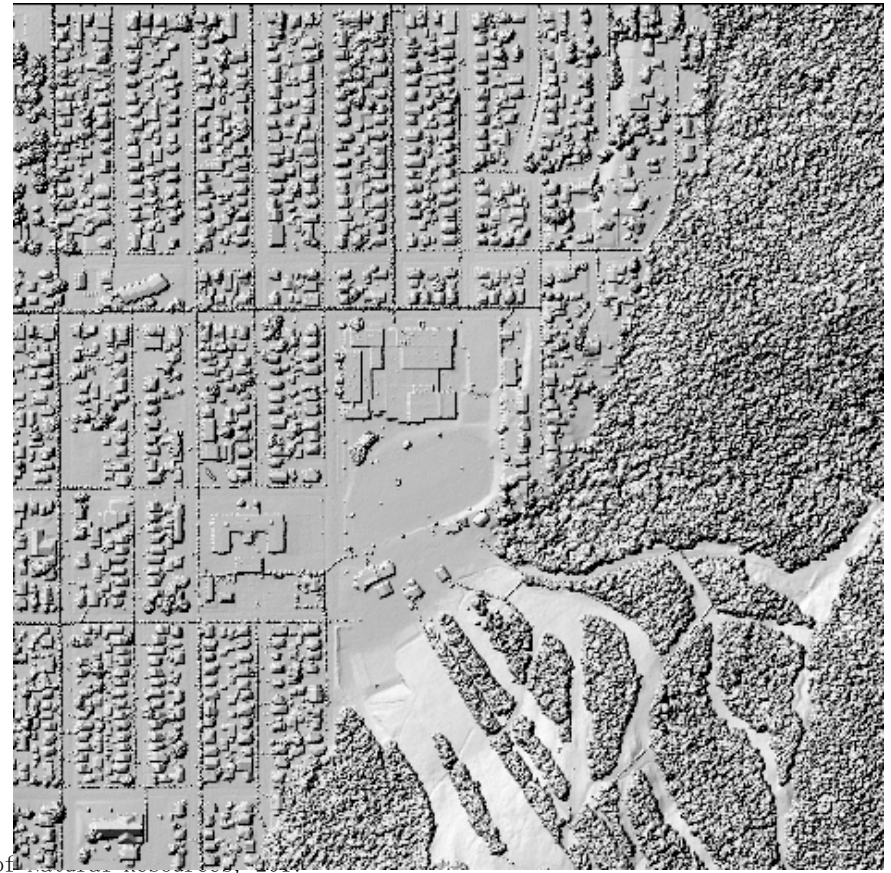
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2m DSM High resolution

World View (Google Earth)



LiDAR DSM (2m)



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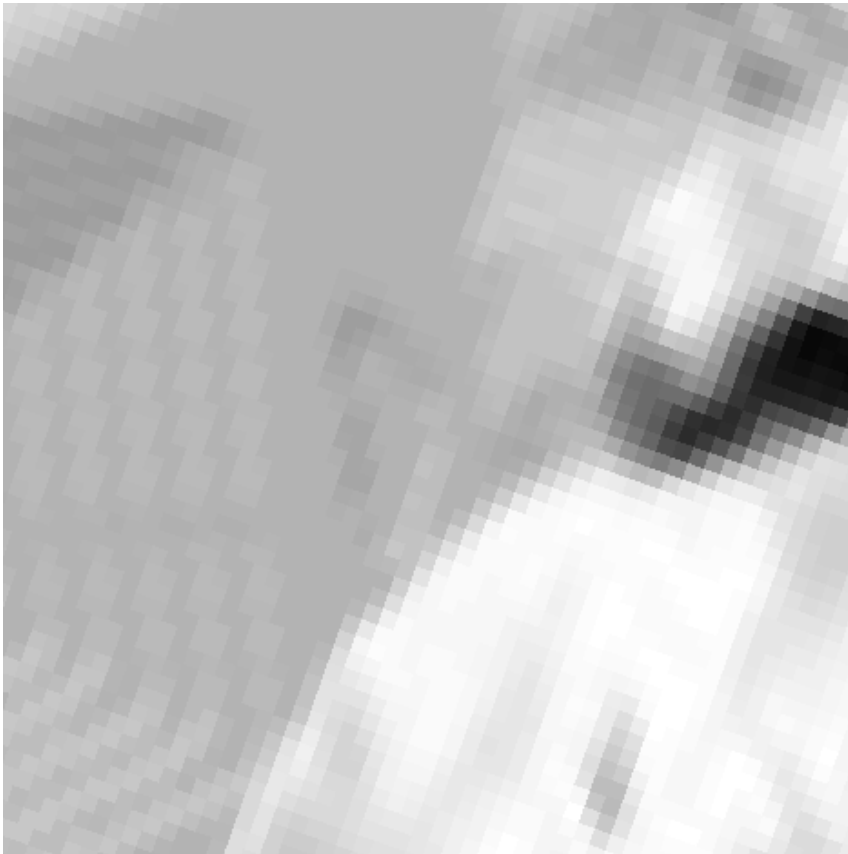
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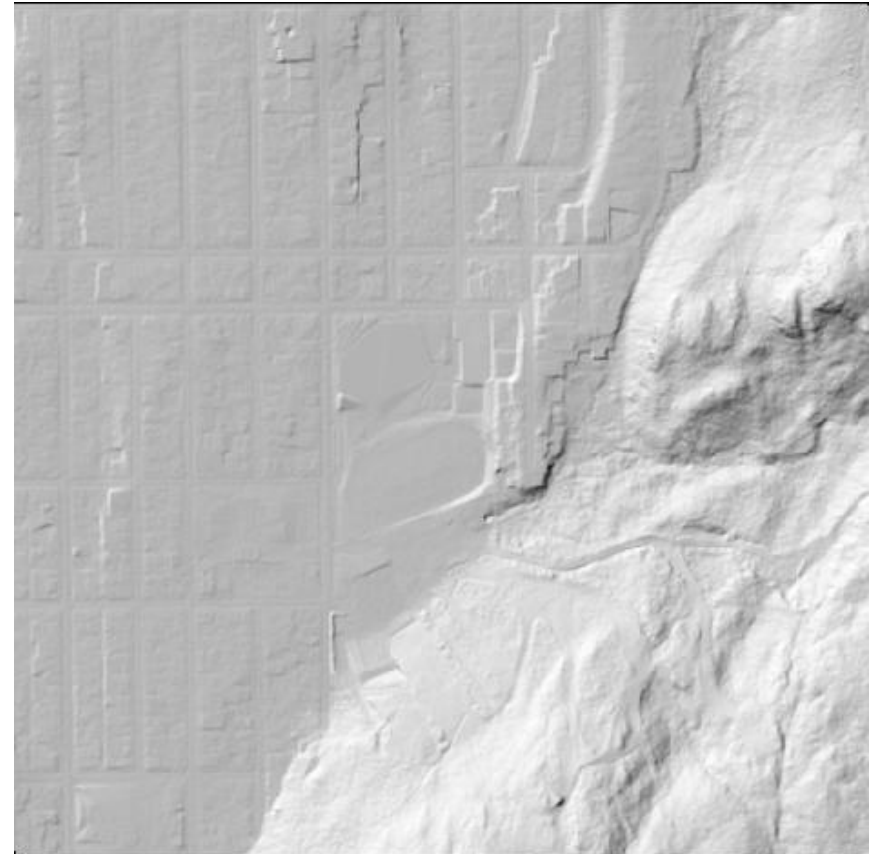
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2m DTM High resolution

CDEM (20m)



LiDAR DTM (2m)



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Canadian Airborne LiDAR Data Acquisition Guideline

- **Deliverable:** A Specification developed from research conducted on the current best practices in collecting airborne LiDAR data across Canadian and international governments along with commercial entities.
- **Community involved:**
 - private industry
 - academic sector
 - provinces and territories
 - federal government
 - USGS
- **National Meeting:** in Ottawa on January 17th, 2017
- **Deadline:** Final version June 2017



National Elevation Data Inventory

1. We are buying more and more elevation data (LiDAR) in the country. **Often cover small areas, uncoordinated.**
2. LiDAR data are costly and have their own limitations:
 - a) **Limited acquisition time frame (no snow, foliage, etc)**
 - b) **High fix cost to initiate a project. Large acquisition area decreases price/km²**
 - c) **Potential for greater profits through reuse and exploitation of often unused attributes (e.g. extract buildings)**
 - d) **Potential economies of scale through group purchasing (Smart Buy)**
3. Best practice. Recommended by USGS. **Where is the information? What is it?**



Next steps

- Canadian Airborne LiDAR Data Acquisition Guideline
 - Contract ongoing to support and coordinate the development
- Create DEM from Lidar data and disseminate data
 - 125 000 km² will be available this spring
 - On Federal Geospatial Platform, Open Maps
- Provide technical support to ArcticDEM project
 - Validate generated data and provide feedback
- Finalize the data management system and production processes
- Collaborate with provinces to openly share LiDAR data
- Continue working with federal departments and coordinate efforts
- Establish federal funding mechanisms
- Populate the national inventory application



Thank-you

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System:

