

Mapping the North: An integrated approach

Earth Sciences Sector



Geomatics for Northern Development

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CANADA'S NATURAL RESOURCES

NOW AND FOR THE FUTURE

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Natural Resources
Canada

Ressources naturelles
Canada

Canada



Presentation plan



- Our topographic data collection
 - Data sources
 - Base data
 - Acquisition of new data
- Our Northern mapping task
 - Map conversion
 - Map updating
 - New mapping
- Data access



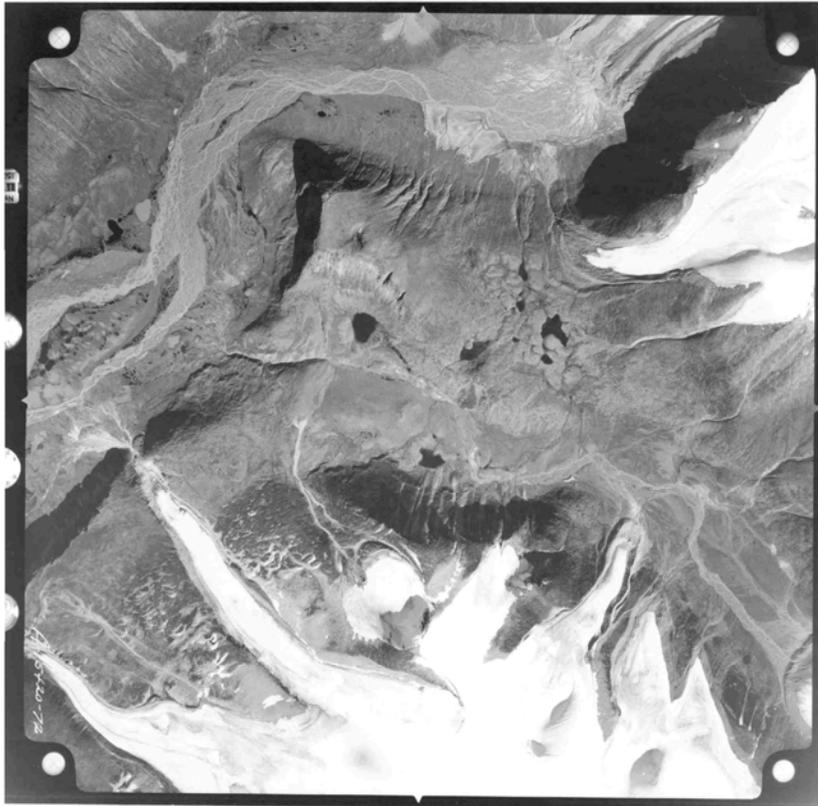


Data sources at NRCAN



- Aerial Photography

- More than 6 millions photographs covering Canada
- 1920 to today
- Managed by National Air Photo Library
- Traditionally used to create maps

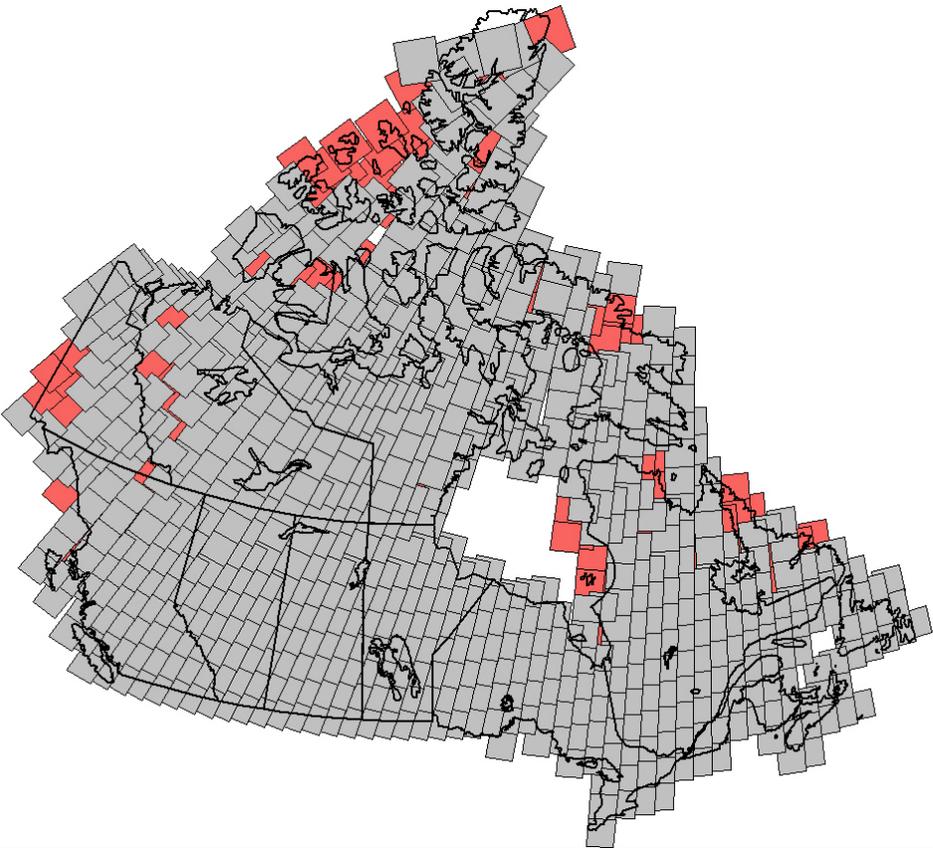




Data sources at NRCAN



- Satellite imagery
 - More than 700 Landsat ortho-images
 - 1995 to 2004
 - Less detailed than aerial photography
 - Used to update maps
 - www.GeoBase.ca

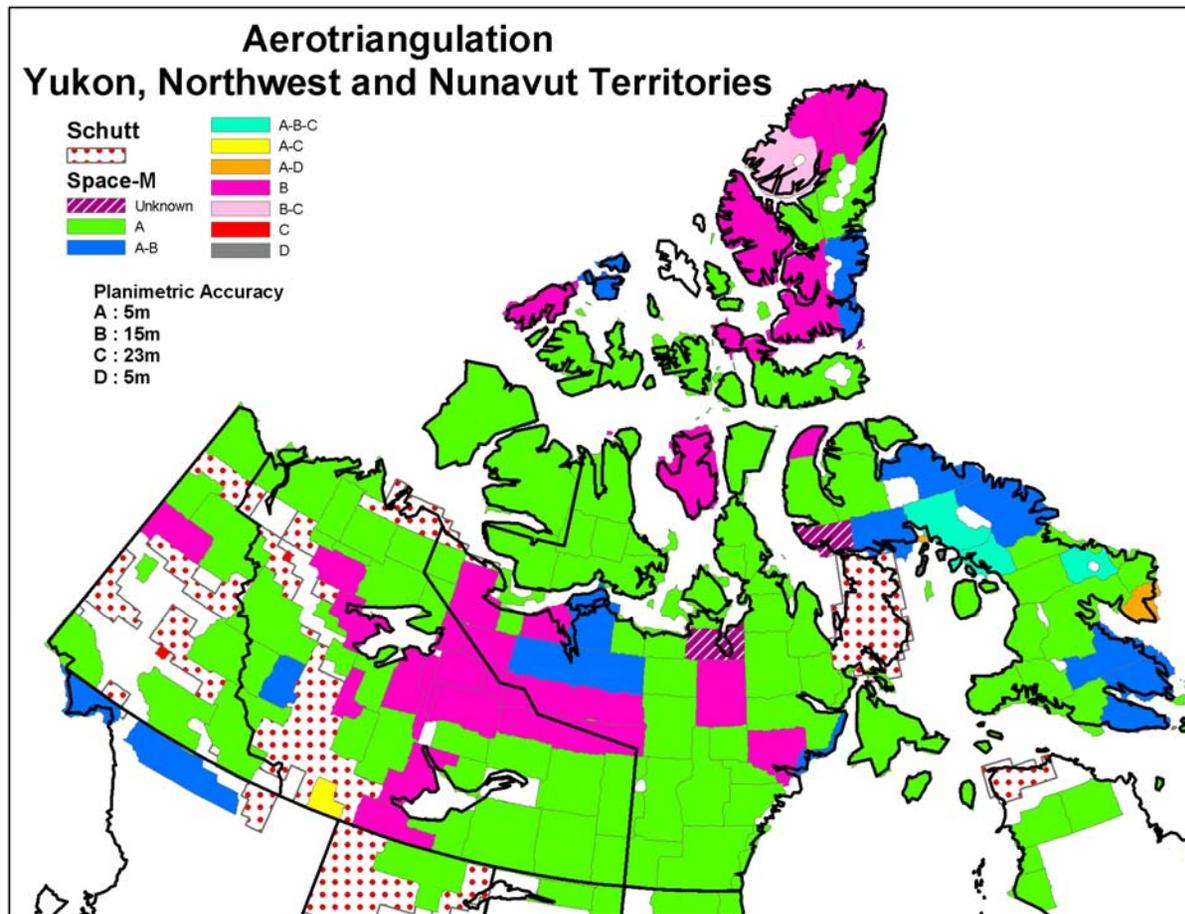




Data sources at NRCAN

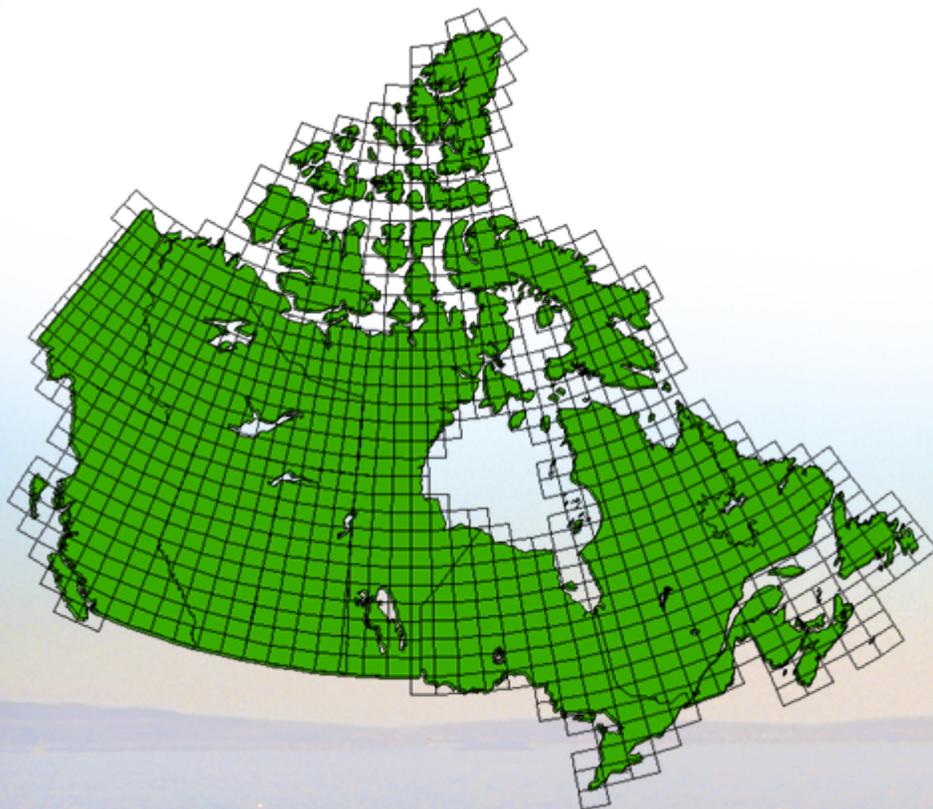


- Aerial Survey Data Base





Topographic data at NRCan



- 1 : 250 000
~ 980 datasets
- 1: 50 000
~13000 datasets

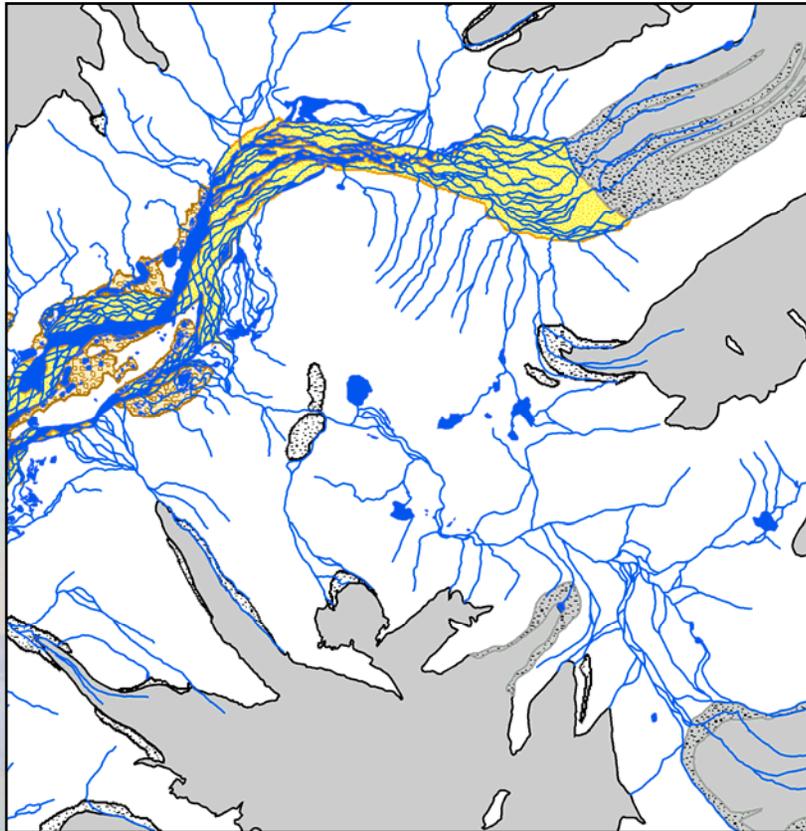




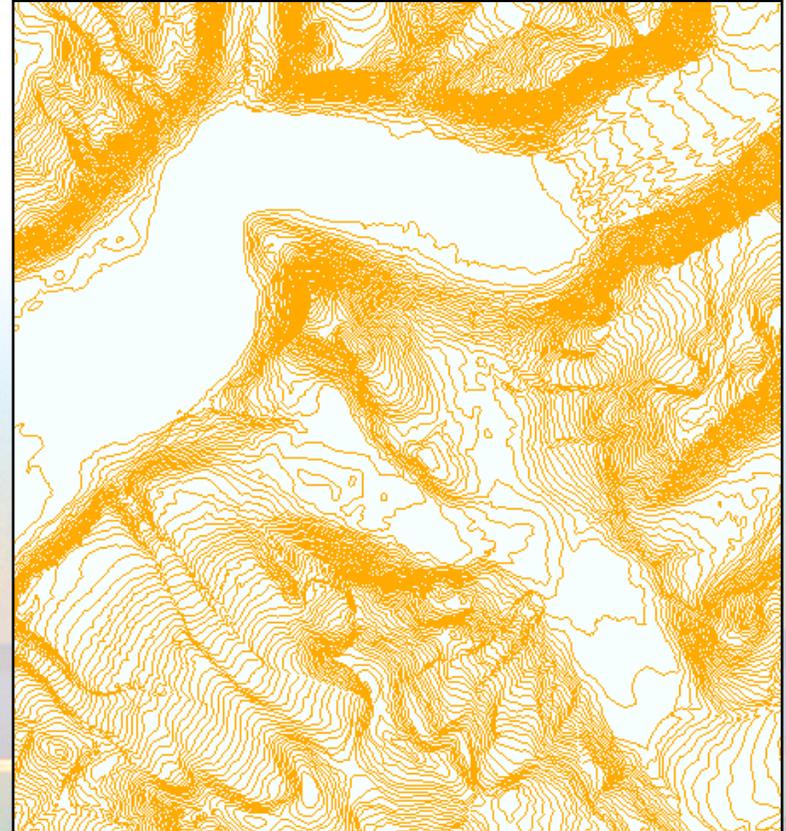
Behind the map ... the data base



Planimetric content

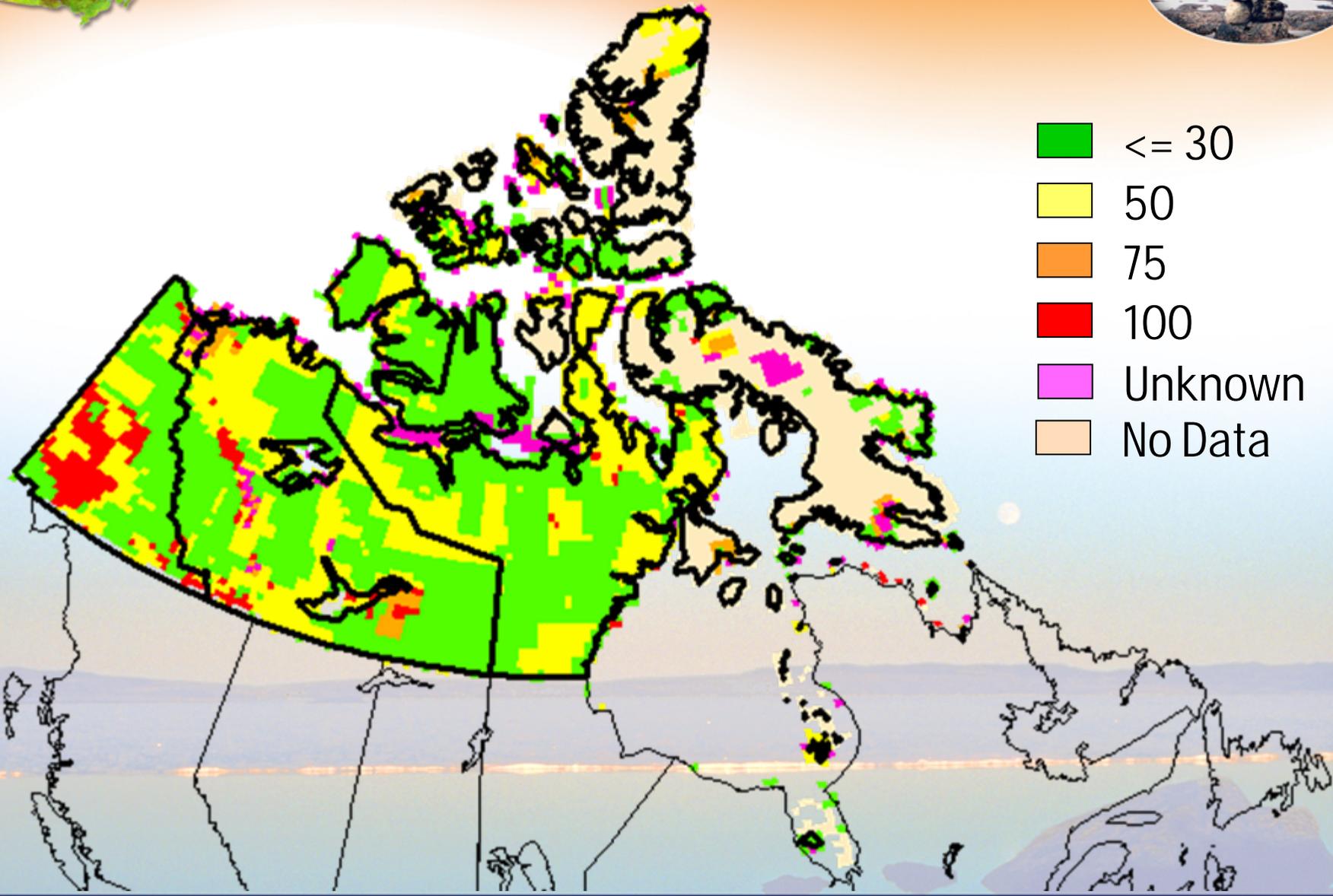


Altimetric content



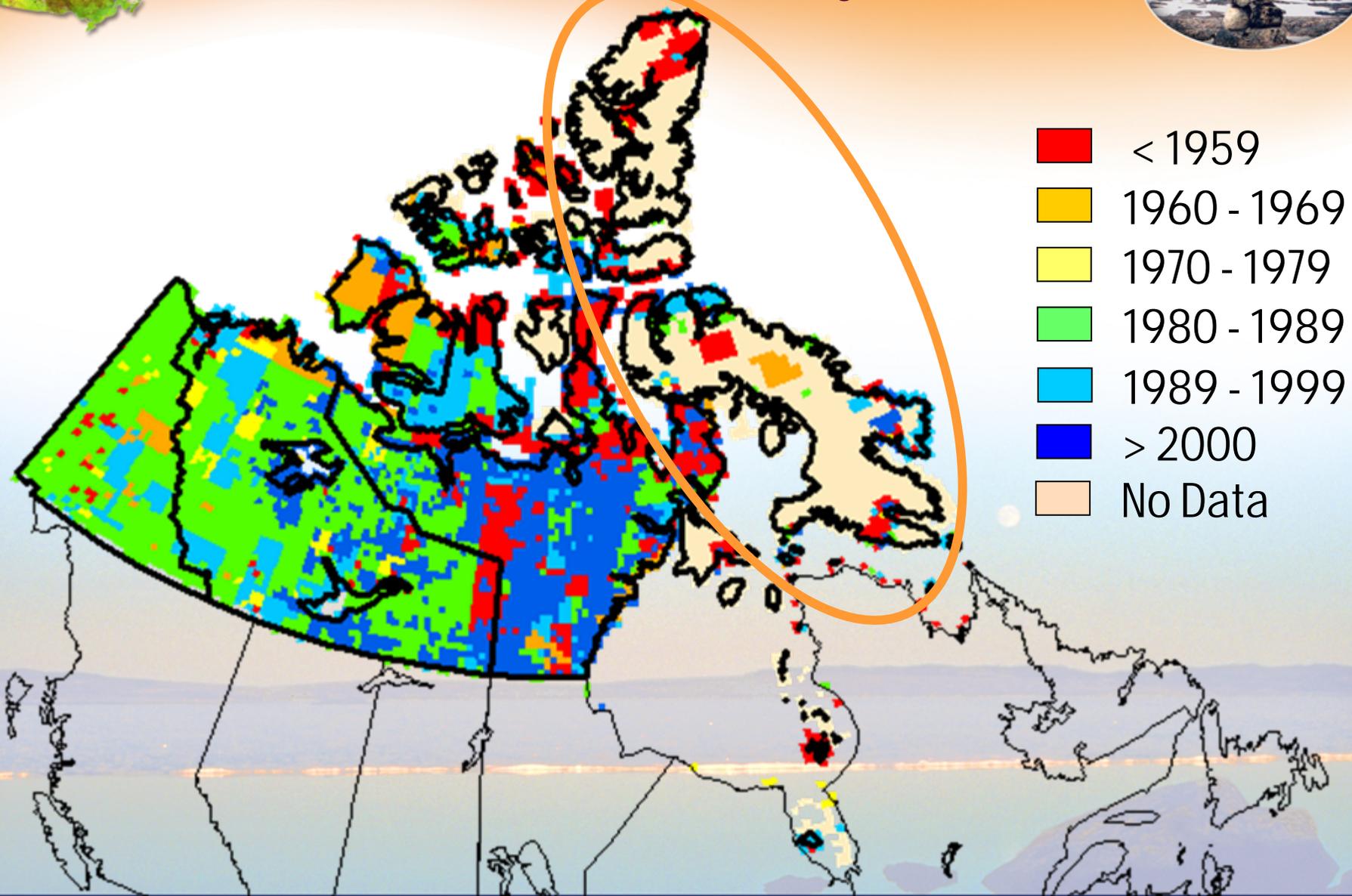


1 : 50 000 – Planimetric accuracy



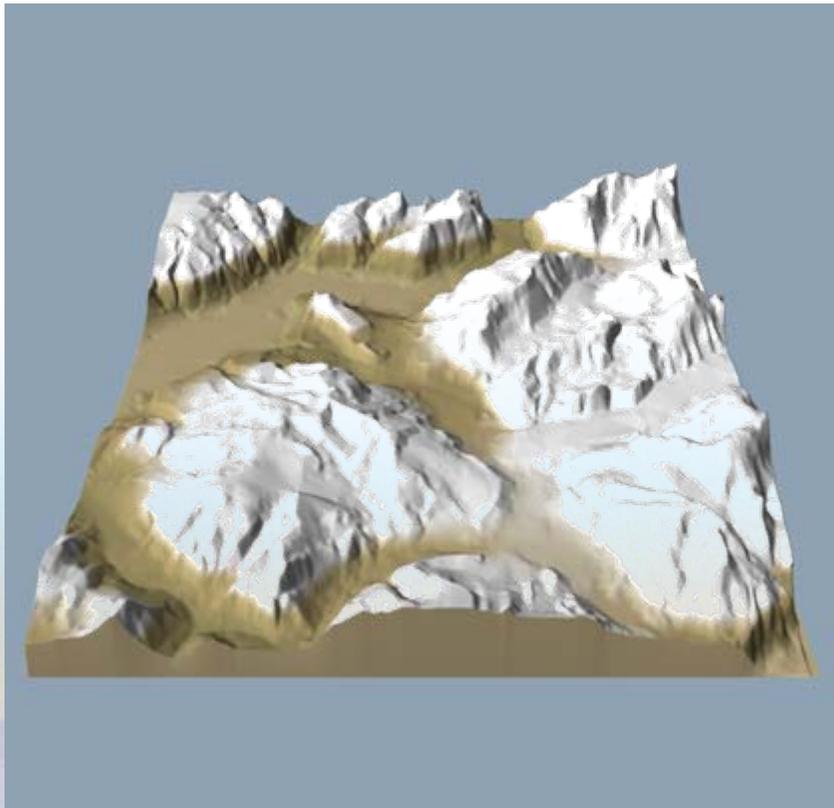


1 : 50 000 - Validity





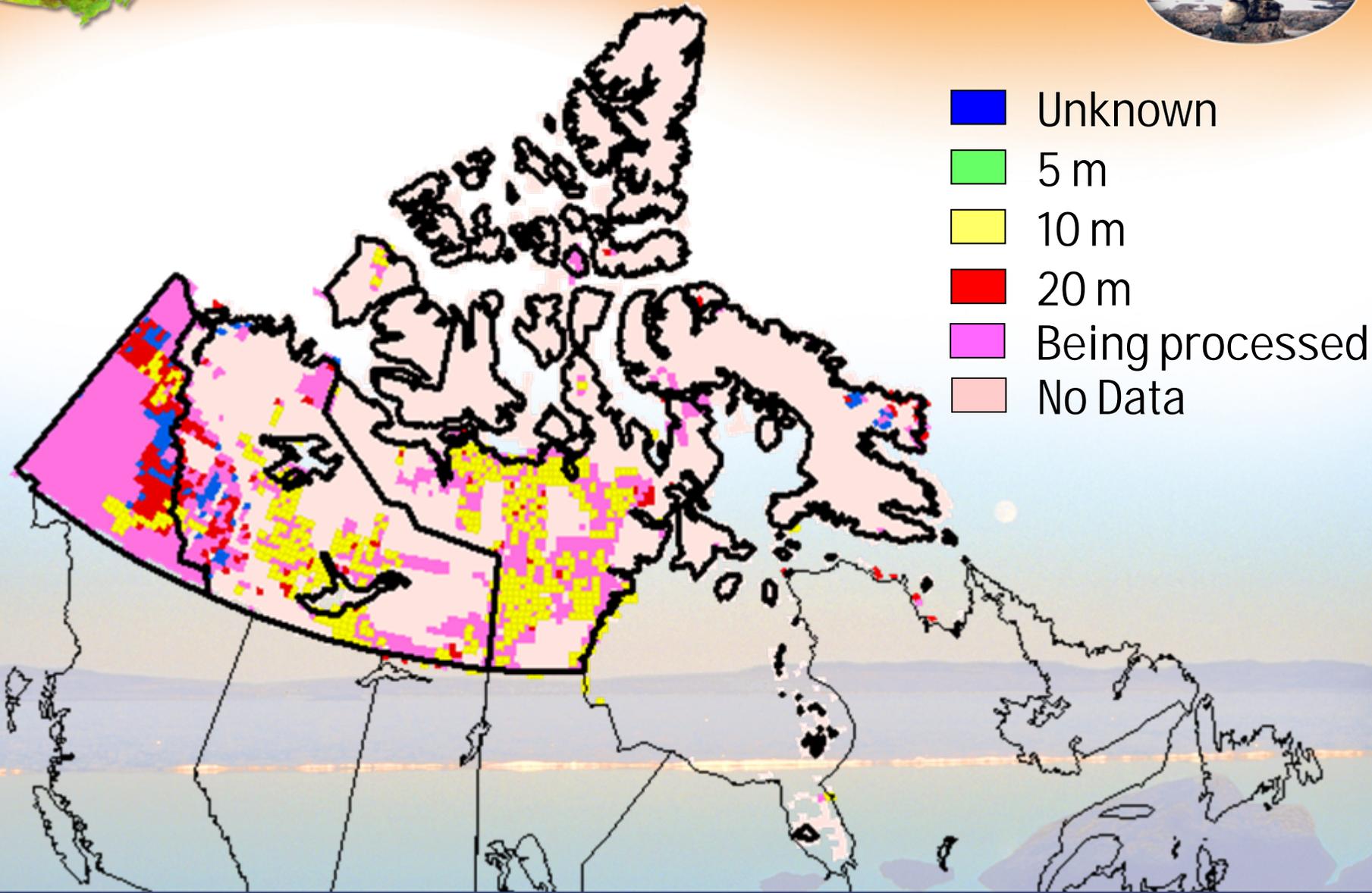
Canadian Digital Elevation Data (CDED)



- DEM (Digital Elevation Models)
 - Built from contours
 - 1 : 50 000
 - 1 : 250 000



1 : 50 000 – Altimetric accuracy

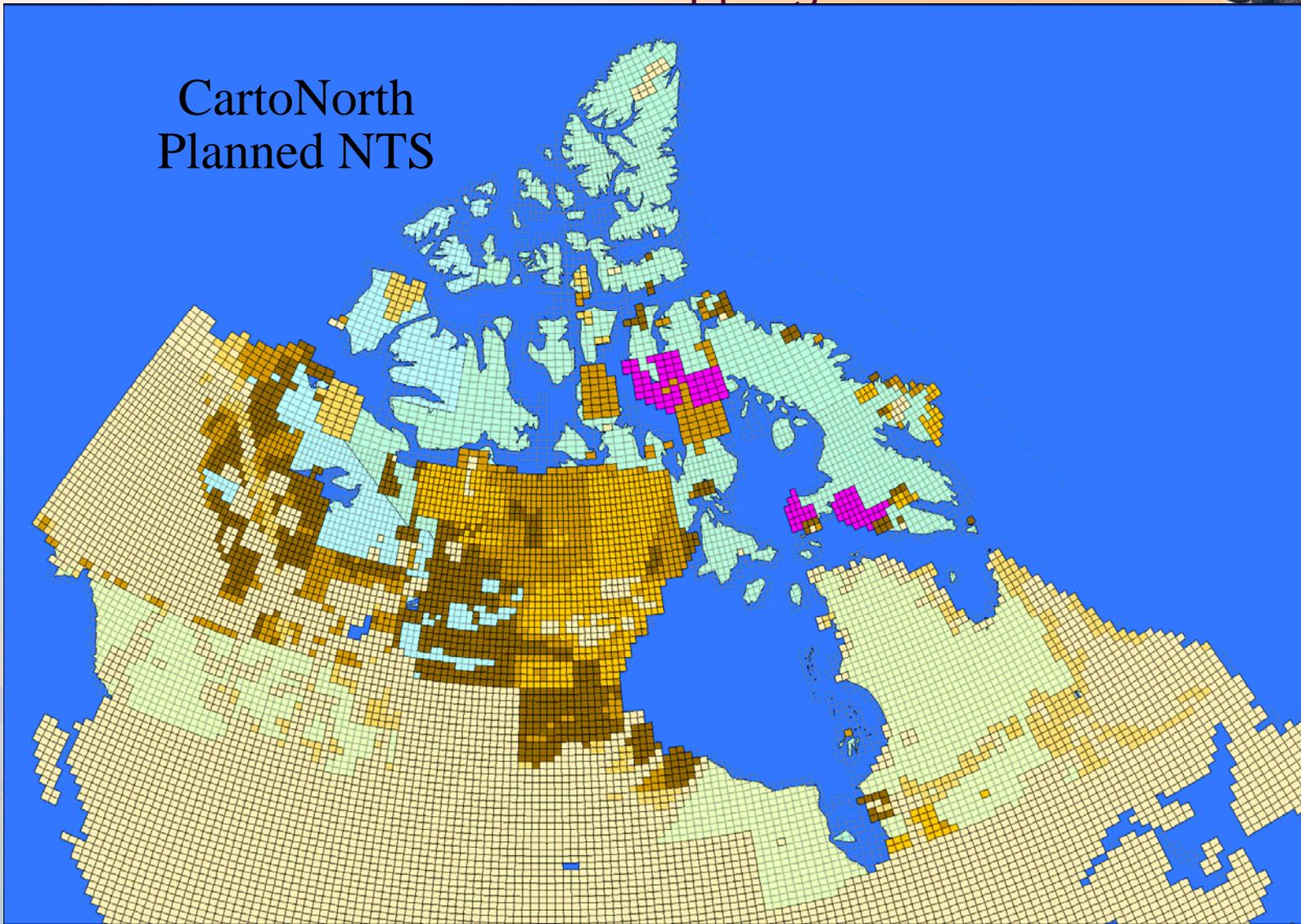




NRCan's Mapping Task And the Northern Mapping Effort

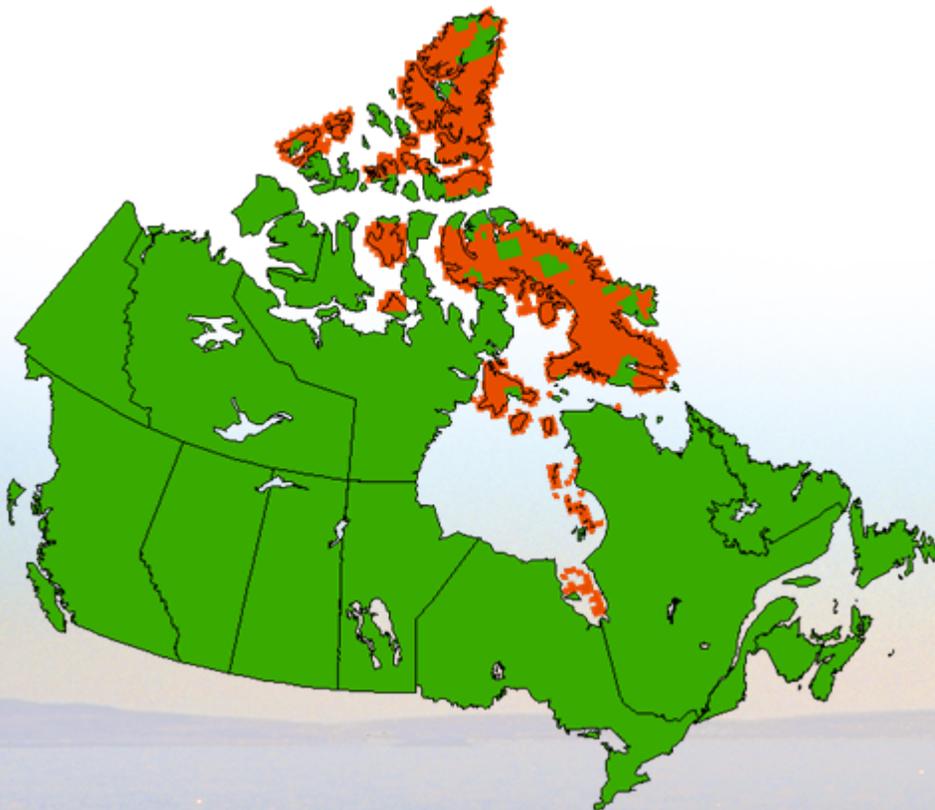


CartoNorth
Planned NTS





CartoNord project: New mapping



- Produce 1 : 50 000 data (planimetry and altimetry)
 - ~ 1500 datasets
 - ~ 800 000 km²





CartoNord objective



- Test new and old technologies
 - Compare results
 - Compare production prices
 - Compare industry capacity
- Recommend one technology
- Build the production system





Mapping challenges

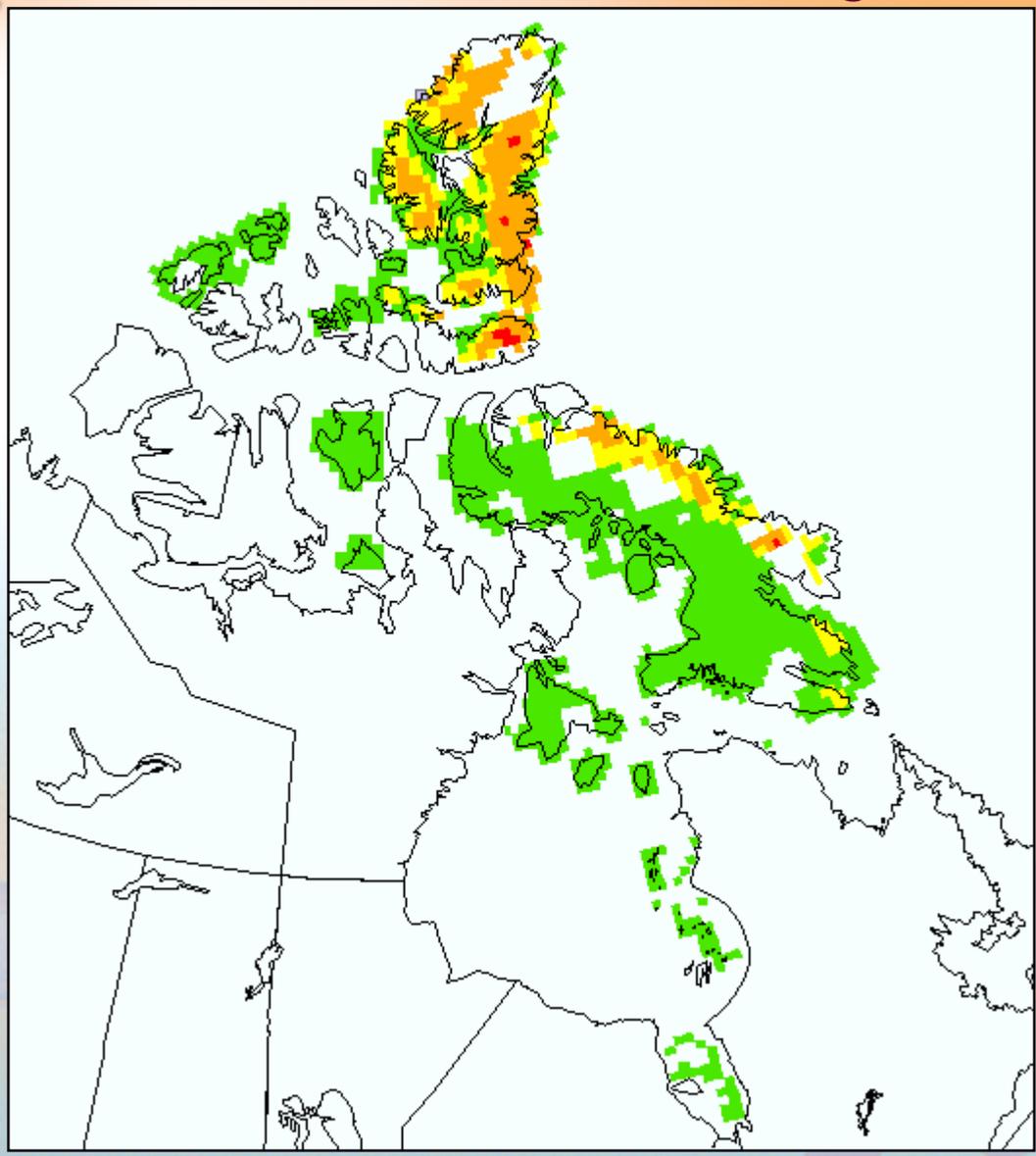


- Limited access
- Summer length
- Clouds cover
- Glacier cover
- Large variety of relief
- Lack of data source





Glacier coverage

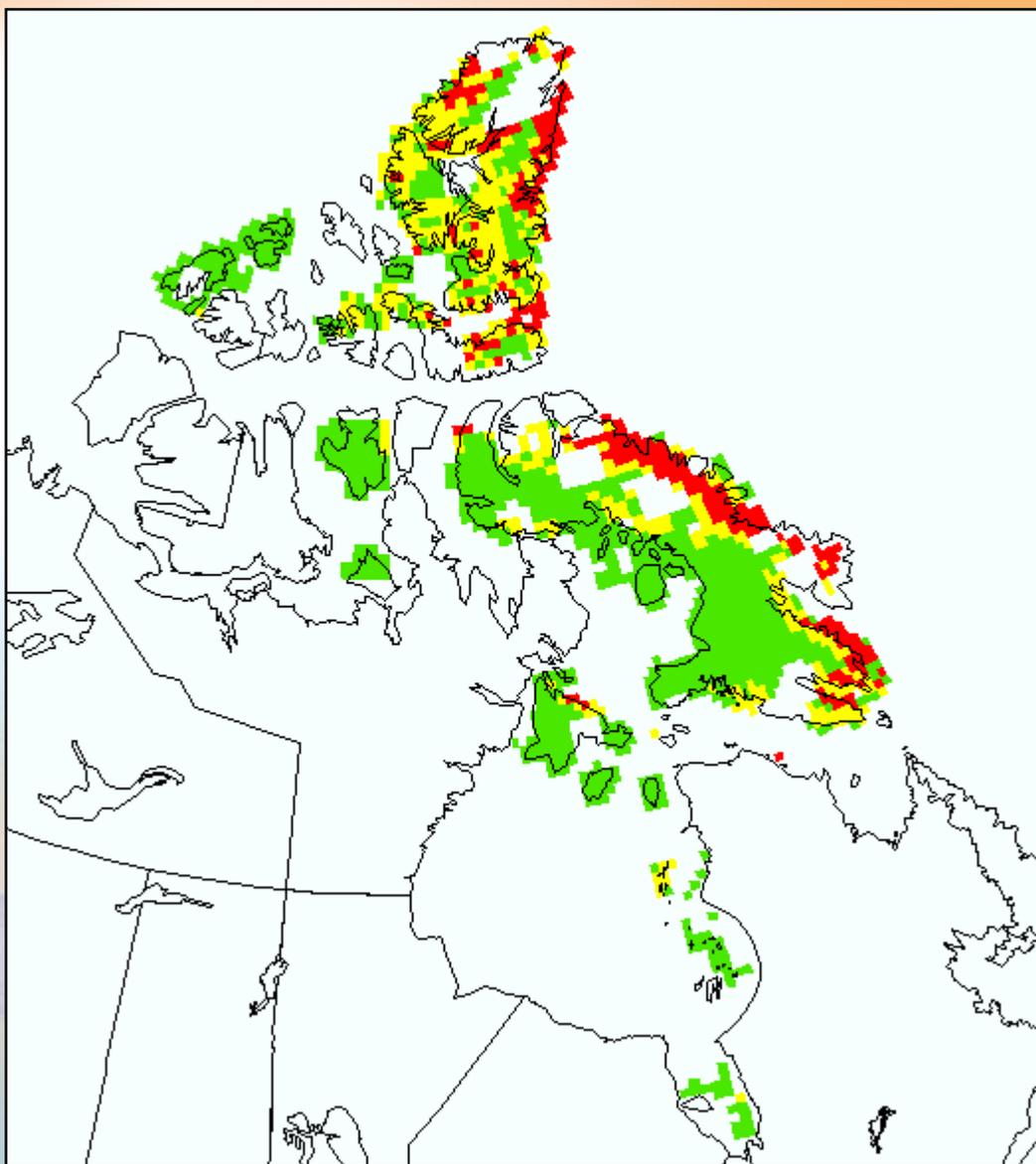


-  0 %
-  < 50 %
-  > 50 %
-  100 %





Relief



-  low
-  moderate
-  high





Main sources available



Data source

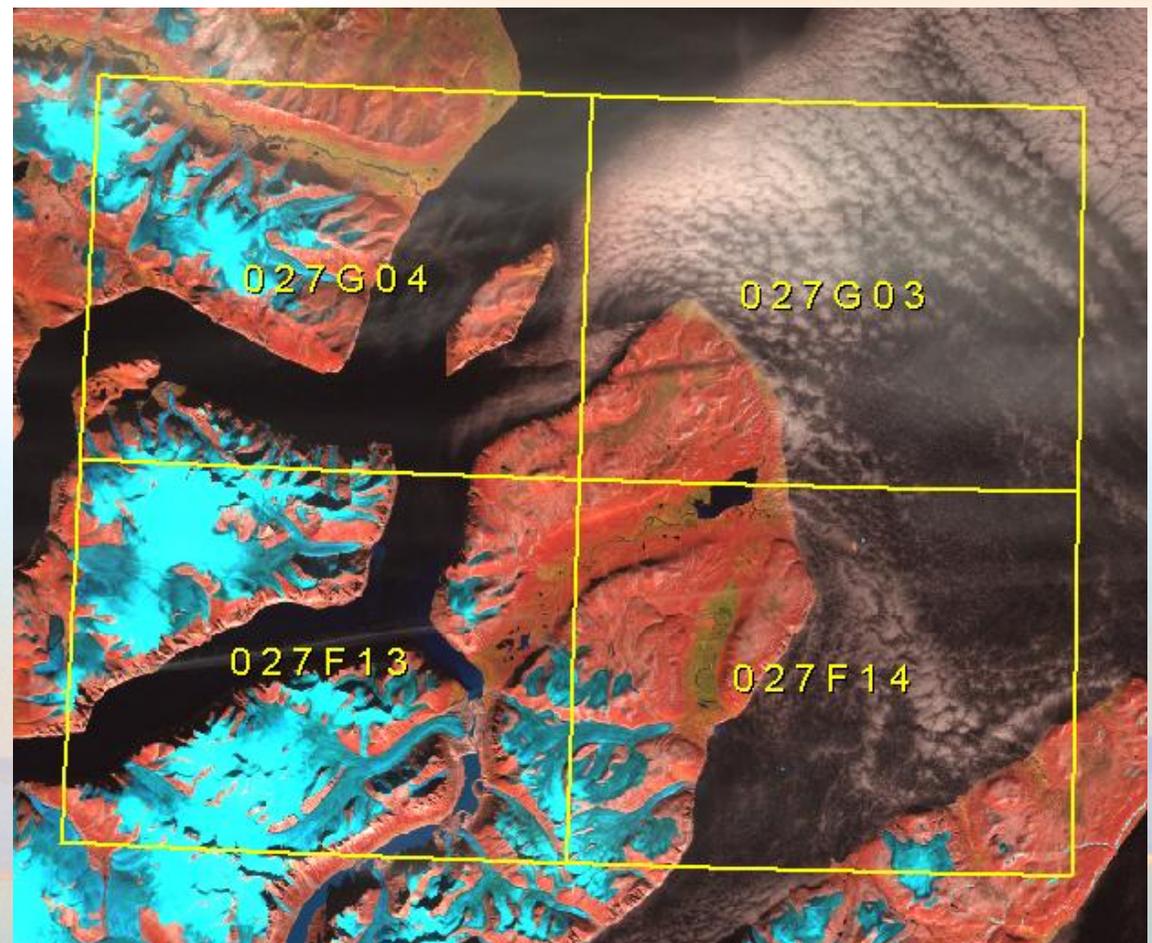
- Aerial photography
- Landsat-7 satellite image
 - Radarsat satellite image
 - ERS satellite image
- Ikonos, Spot, Orbview and other very detailed satellite images

Main limitation

- age (~1960)
- Level of detail
- Less detail, and poor accuracy
- Low-moderate terrain
- Price, rights, and availability

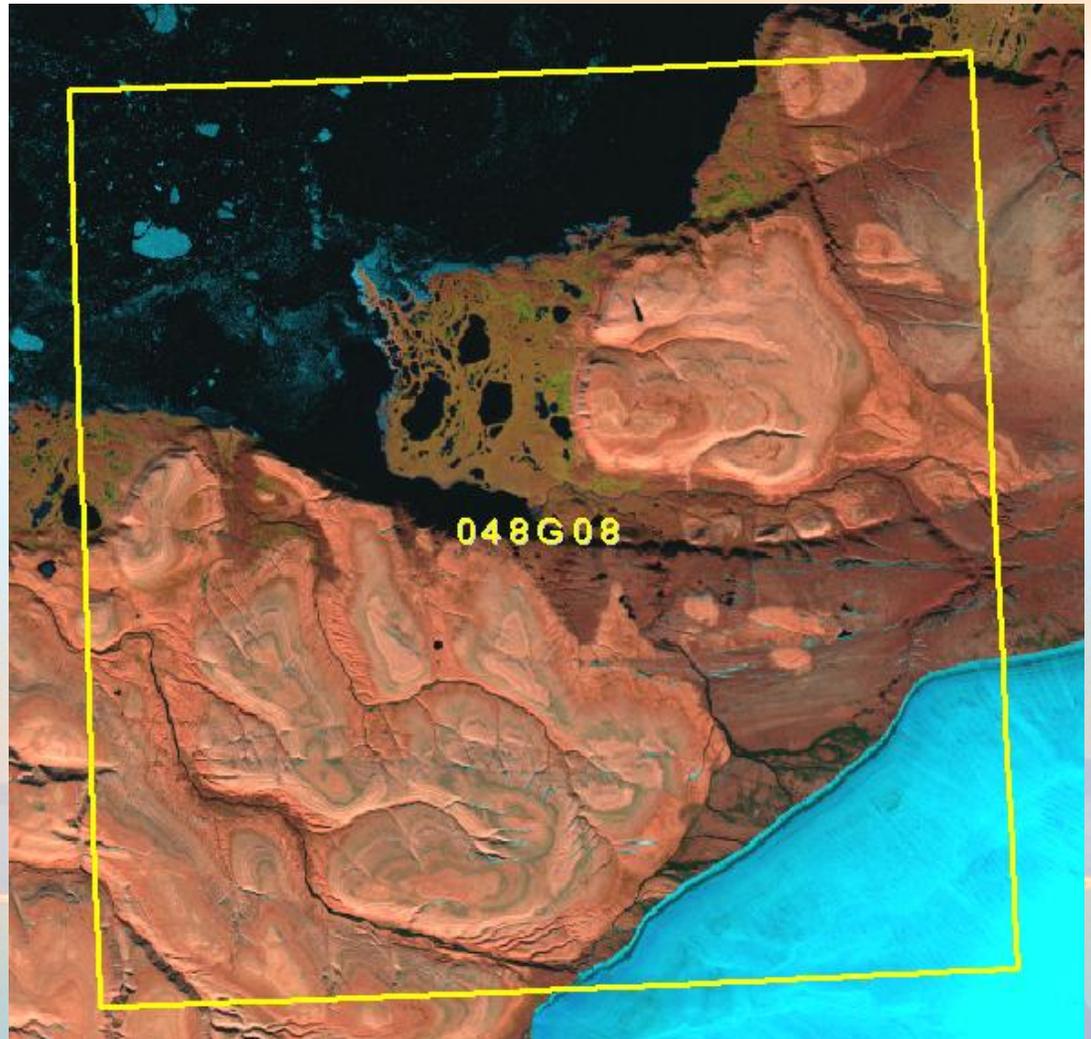


Test zone 1 : Clyde River





Test zone 2 : Devon Island





Results

Planimetry

Data source	Absolute error	
	27F13	27F14
Aerial photographs	20	20
Landsat7 (2D)	28.5	35.1
Landsat7+Radarsat (3D)	41.5	33.4
Radarsat (3D)	164.8	107.9
250K	127.2	170.4

Method	Major Conclusions	Planimetric Quality
Air Photo	<ul style="list-style-type: none"> • Best results, very good details and accuracies • Needs updating (existing process) 	****
Landsat	<ul style="list-style-type: none"> • Detailed results, better than 250K • Interpretation problems with linear hydrography (~35% of results by air photo) and wetlands 	**
Radarsat/Landsat	<ul style="list-style-type: none"> • Similar to Landsat only 	**
Radarsat	<ul style="list-style-type: none"> • Many errors in data content and accuracies. Avoid 	--
250K, not rectified	<ul style="list-style-type: none"> • Accurate content but with many omissions, positional errors and generalisation 	--
250k, rectified	<ul style="list-style-type: none"> • Accurate content but with many omissions and generalisation 	*





Results

Altimetry

Méthod		Terrain (metres)		
		Flat	Average	High
Stereocompilation	Air photo	--	10.07	12.44
Radargrammetry	Autocorrelation	39.38*	63.66	134.69
	3D	26.7*	41.82	61.97
Interferometry	ERS	--	14.26	--
	RADARSAT	--	58.01	--

Method	Major conclusions	Altimetric Quality
Air Photo	<ul style="list-style-type: none"> Accurate and conform with terrain but not updated* 	***
Radarsat (3D)	<ul style="list-style-type: none"> Less accurate and conform with terrain and up to date 	**
Radarsat (Interferometry)	<ul style="list-style-type: none"> Less accurate and conform with terrain and up to date 	**
Radarsat (autocorrelation)	<ul style="list-style-type: none"> Inaccurate and not conform to terrain 	--
ERS (Interferometry)	<ul style="list-style-type: none"> Accurate and conform with terrain and up to date Not applicable in very steep terrain 	***
250K	<ul style="list-style-type: none"> Inaccurate and conform with terrain but not updated 	*





Recommendation



- Technology meeting 1:50,000 scale standards
 - Planimetric data capture in 3D mode.
 - Existing aerial photography updated with Landsat7 ortho image (in the short term)
 - Stereo images from alternate EO data sources (SPOT,...) matching accuracies, content and costs of aerial photographs (in the long term)
 - Altimetric extraction with ERS/InSar on flat and moderate terrain. Alternate EO data sources where no InSar data available.





Recommendation,...



- Objectives
 - Production based on stakeholder priorities
 - Production rate : 20 (2004), 190 (2005), 150
 - ...
- System Developement
 - Modify existing procedures
 - Specifications and metadata
 - Develop altimetric inspection procedure
- Acquisitions
 - Software/Hardware
 - Air photo scanning



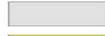


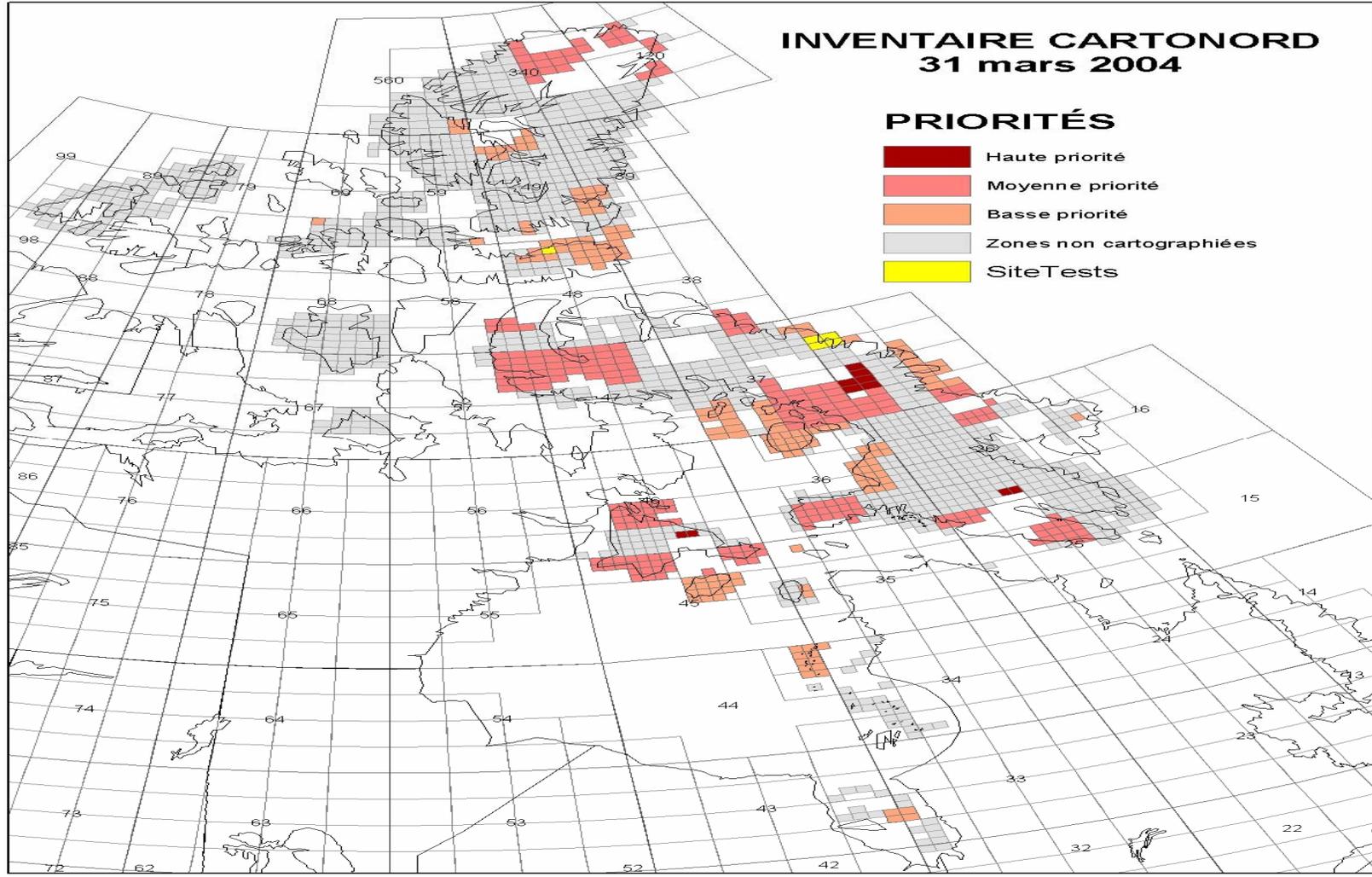
Priorities



INVENTAIRE CARTONORD 31 mars 2004

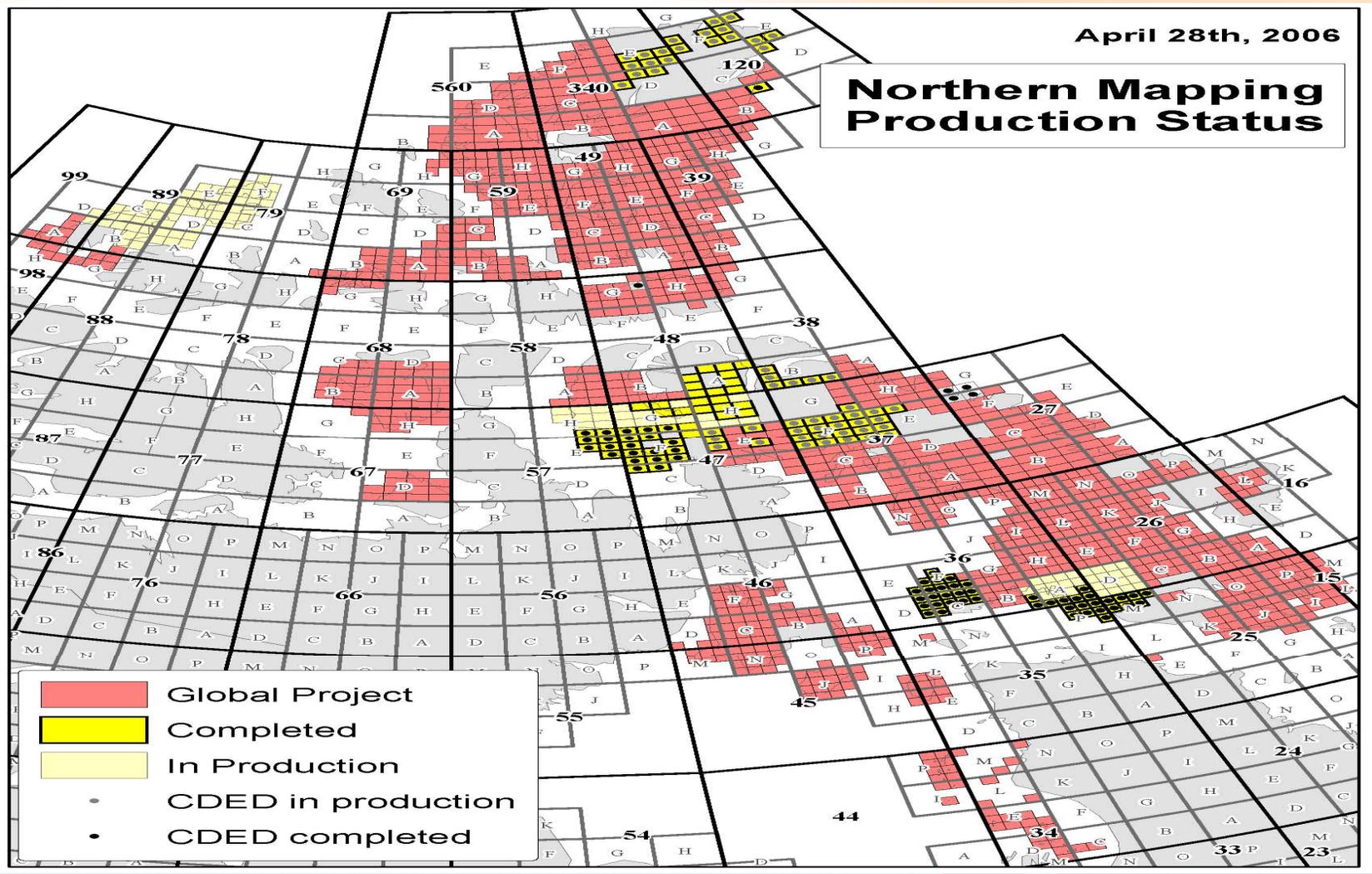
PRIORITÉS

-  Haute priorité
-  Moyenne priorité
-  Basse priorité
-  Zones non cartographiées
-  Site Tests





Production status





WorkStations



- Pentium IV 3Ghz
- 1,5 GO de RAM
- CRT high res. (118 Hz) 1280 x 960
- LCD flat screen 1152 x 864
- Stereographics ZScreen





Inspection Environment Planimetry



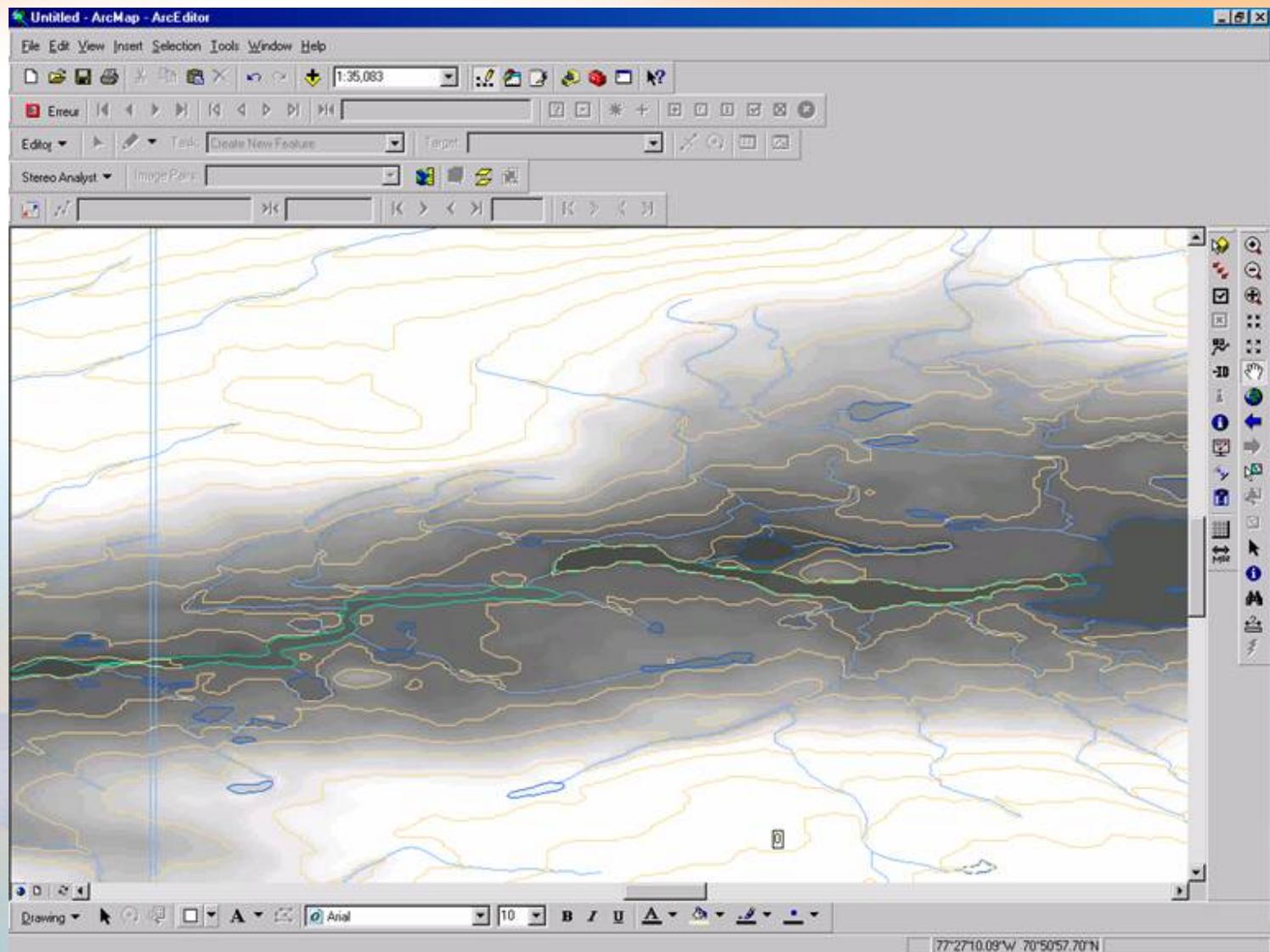
The screenshot displays a GIS application window with the following components:

- Top Panel:** Includes a title bar, a toolbar with navigation and editing tools, and a status bar showing the date "June 21, 2005".
- Main Map Area:** Shows a satellite-style terrain map with a red grid overlay. A yellow line is drawn across the grid, and a blue line is visible in the lower right.
- Legend Panel:** Lists various data layers such as "Topography Point Layer", "NCEM8302 Data (P)", "NCEM8302 raster", and "NCEM8302 raster (P)". It also includes a legend for "Land use" with categories: "Forest", "Water", and "Urban".
- Right Panel:** Contains a detailed view of a terrain feature, showing a dark, winding path or stream bed through a rocky, textured landscape.
- Bottom Panel:** Shows the Windows taskbar with several open applications, including "ESRI ArcMap", "Internet Explorer", and "Windows Explorer".





Inspection environnement Altimétrie

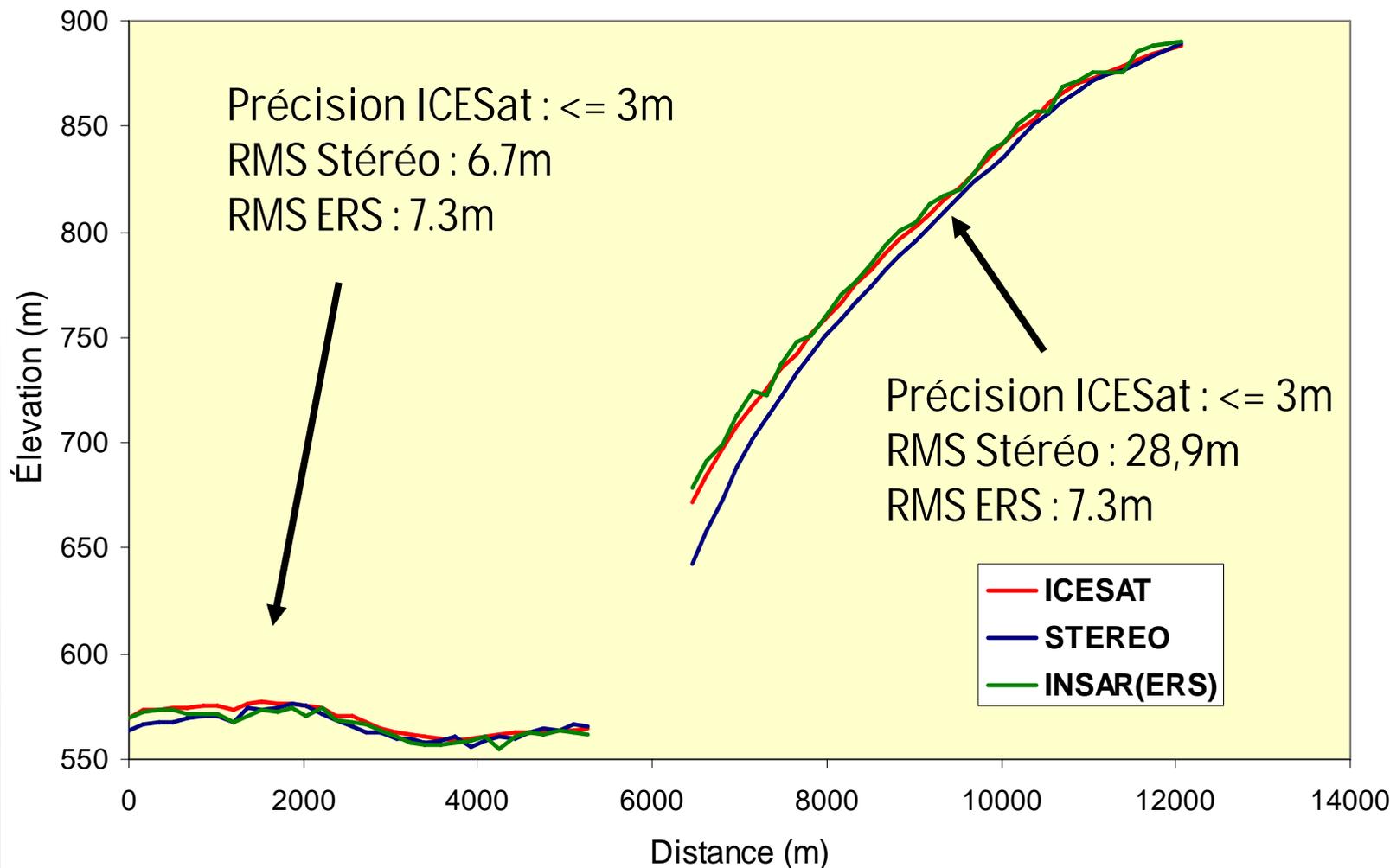




CDED Quality Control: accuracy

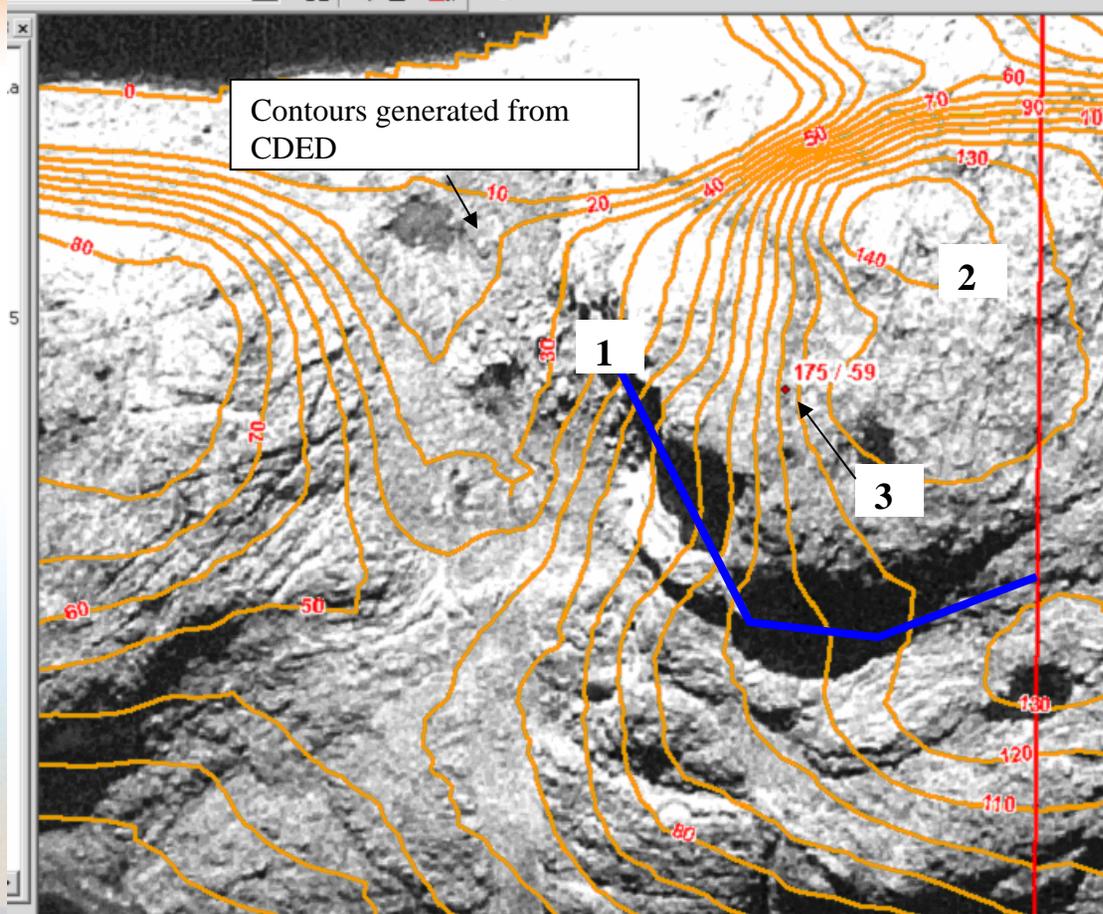


Elevation profiles for Devon Island





CDED Quality Control: content



1. Differences between contour lines and terrain
2. Error in summit positioning
3. Spot height. Summit position
4. 35m difference between photogrammetric model and CDED (175 – 140)

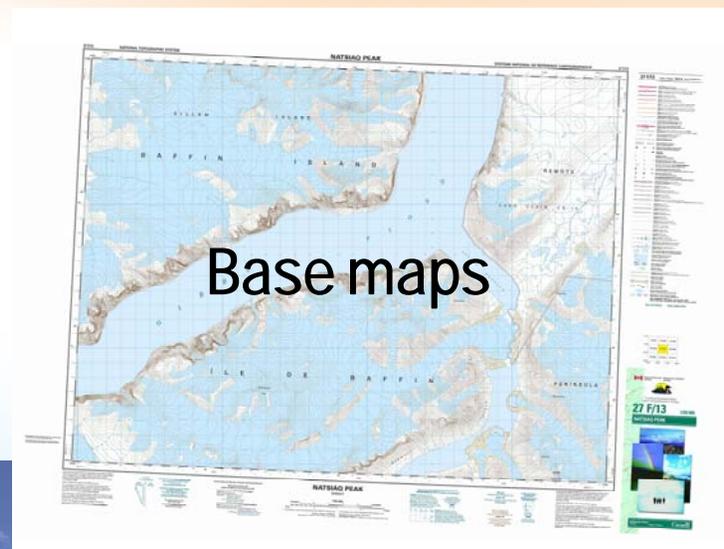




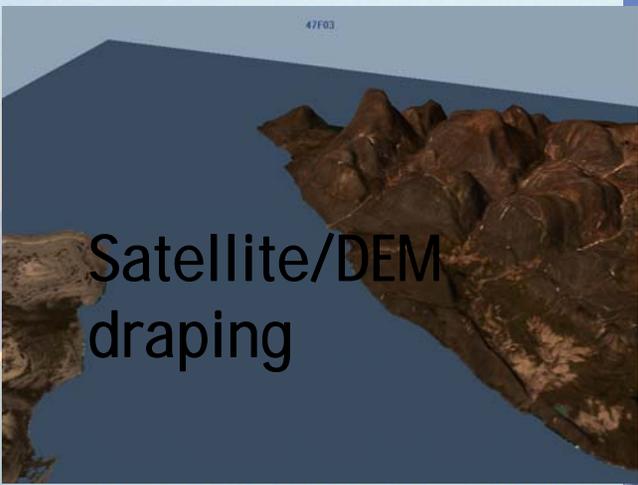
Geospatial Data Base By-products



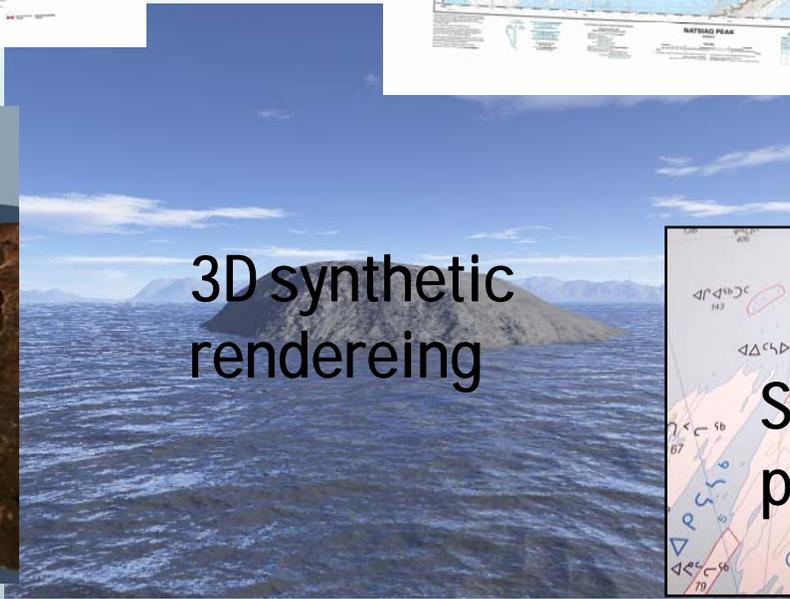
Image maps



Base maps



Satellite/DEM draping



3D synthetic rendering



Special projects



Access to data : Geobase website



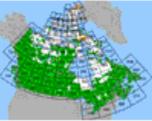

Building on common ground

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Data

Find Data

Option 1 - Graphical Search



1:50,000



1:250,000

Option 2 - Advanced Search

Identifier: (Ex: 031G, 031)

Region:

Coverage:

Publication Date: (yyyy)

Submit

Option 3 - Browse the FTP directory for massive download

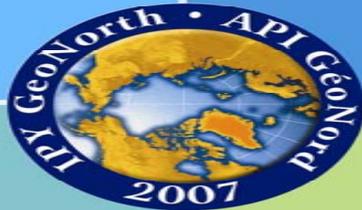
Link to [FTP download folder](#) is modified on a regular basis, however the current link will remain available for at least the next 24 hours.

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- SEE YOU IN YELLOWKNIFE
- 20-24 August 2007



IPY GeoNorth 2007

First International Circumpolar
Conference on Geospatial Sciences
and Applications

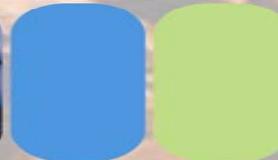
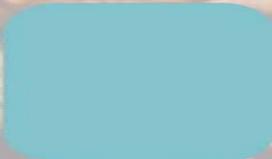
Yellowknife, NORTHWEST TERRITORIES, CANADA
August 20 to 24, 2007

API GéoNord 2007

Première conférence circumpolaire
internationale sur les sciences géospatiales
et leurs applications

Yellowknife, TERRITOIRES DU NORD-OUEST, CANADA
Du 20 au 24 août 2007

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Thank you



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