



TOPOGRAPHIC DATA ACQUISITION IN CANADA'S ARCTIC WITH RADARSAT-2 IMAGERY

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11th International Circumpolar Remote Sensing Symposium, Cambridge UK, sept 2010



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Presentation



- Topographic Mapping Initiative
- Radarsat-2
 - Image Acquisition
 - Model Precision
 - Data extraction/accuracy
- Data Availability

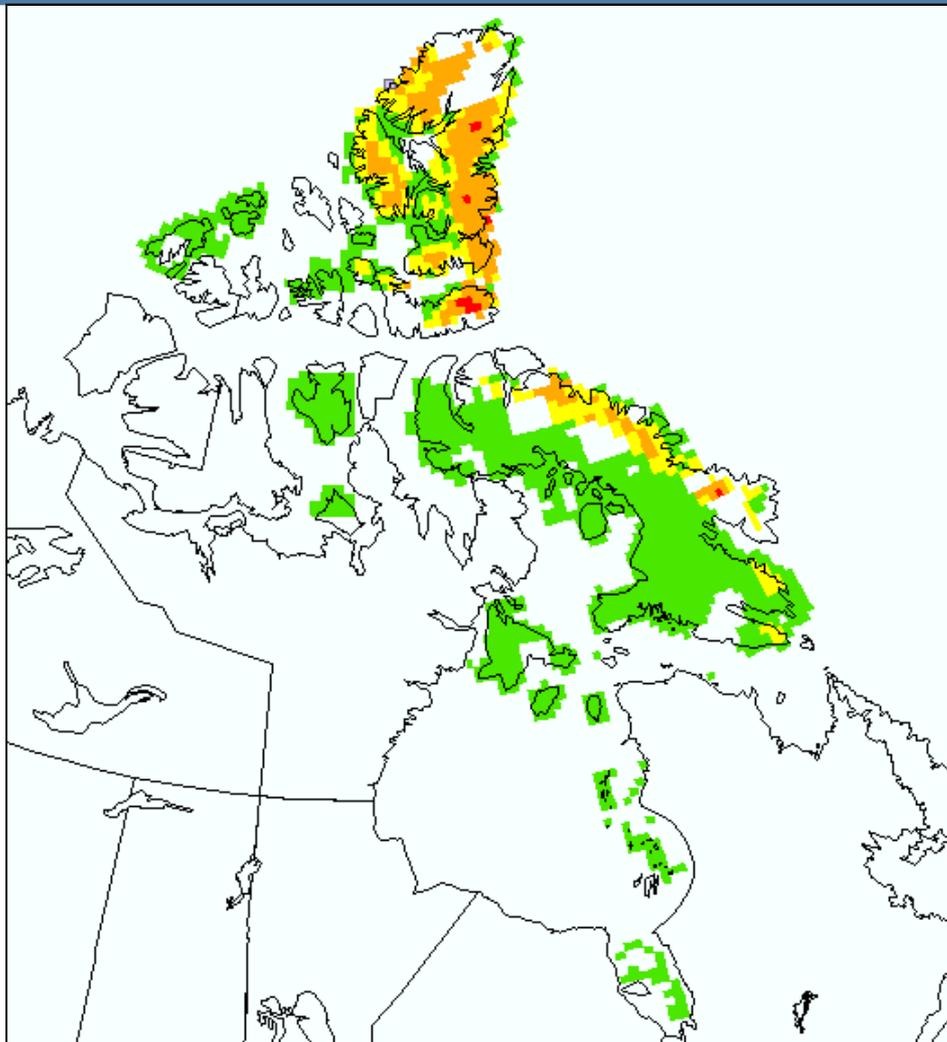
Canada's North



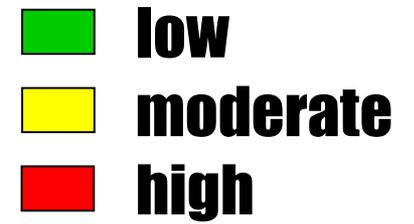
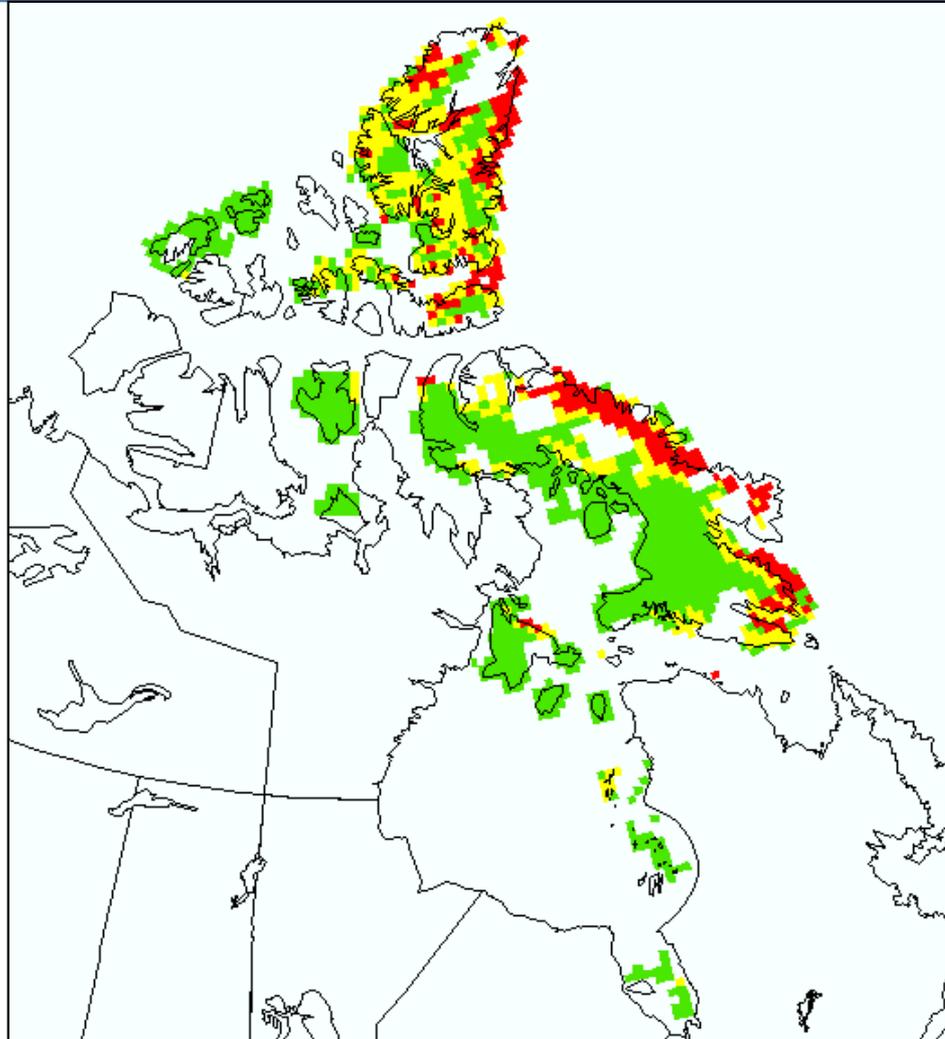
- **Nunavut : 21% of Canada's landmass**
- **Northwest Territories : 13,5% of Canada**
- **Yukon : 5% of Canada**



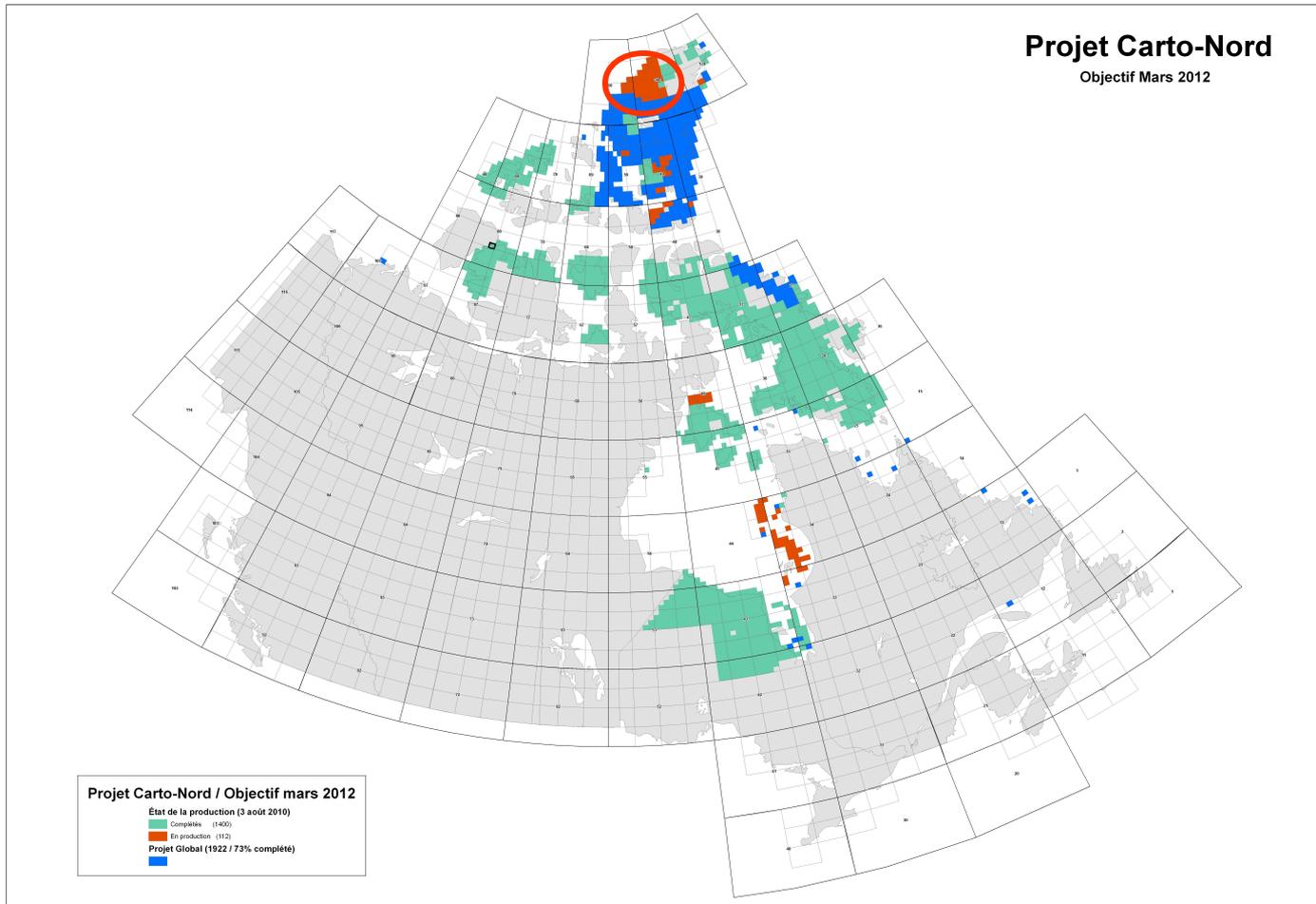
Glacier coverage



Relief



Topographic Mapping Project



X:\geomatics\enr\enr\Productions\Communauté\enr_2010\enr_2010.mxd



Radarsat-2 Project



- Joint CCRS/CTIS Project
- Partnership with CSA/GRIP program
- Feasibility tests: 2008-09
- Implementation: 2009-10
- Exp. production: 2010-11



Copyright Roscosmos and TsENKI



Image Acquisition



- APT software

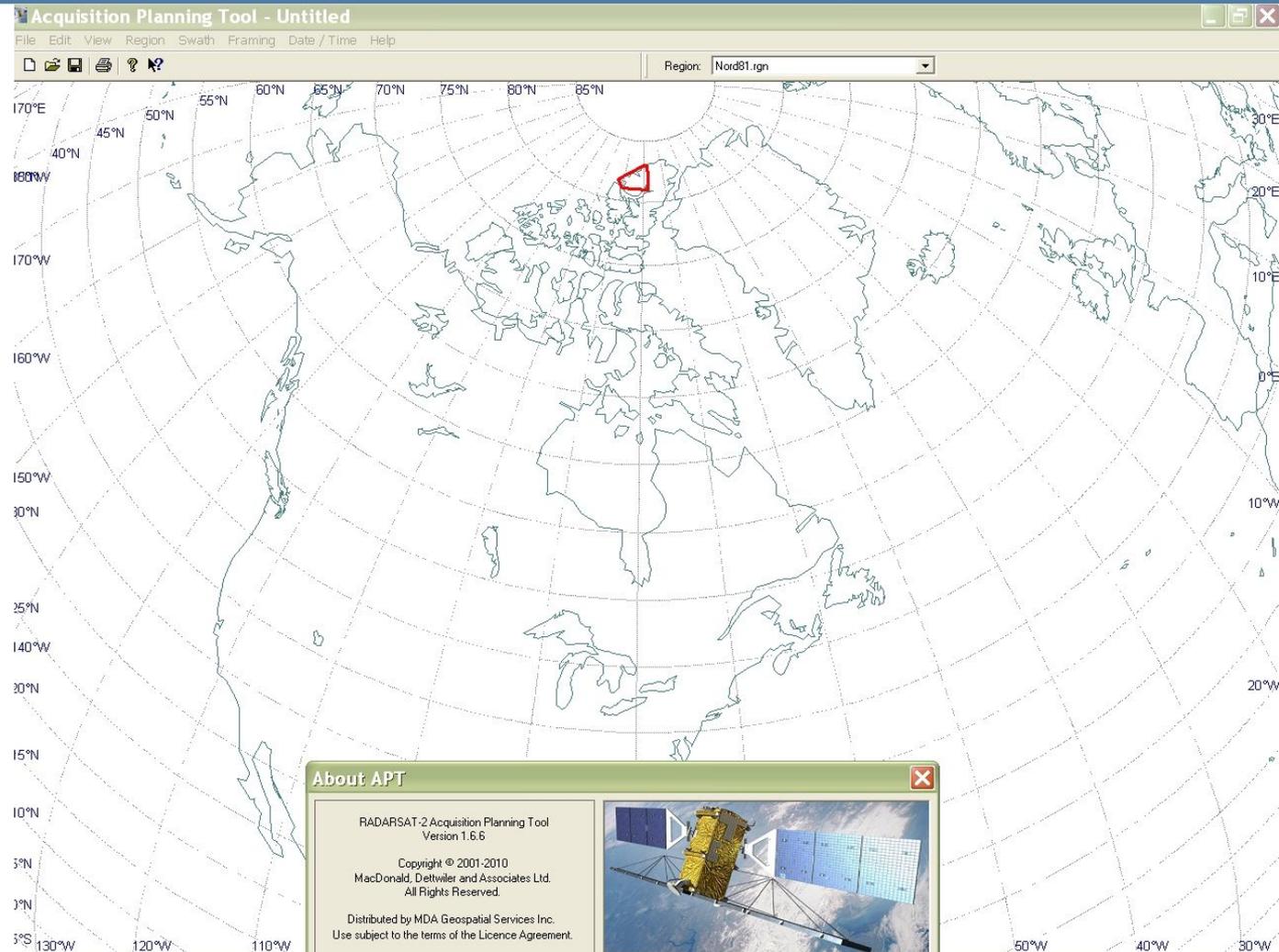


Image Acquisition...



Acquisition Planning Tool - Nord81.acp

Region: Nord81.rgn

Generate Swath Footprints

Start: 2010-AUG-01 13:14:39.533
Stop: 2010-AUG-31 13:14:39.533
UTC Time Reset to Epoch

Direction: Ascending and Descending
 Ascending Only
 Descending Only

Mode: Ultrafine
Beam: U10
to: U27

Tx Polarization: H
 V
 H+V

Fix Polarization: H
 V
 H+V

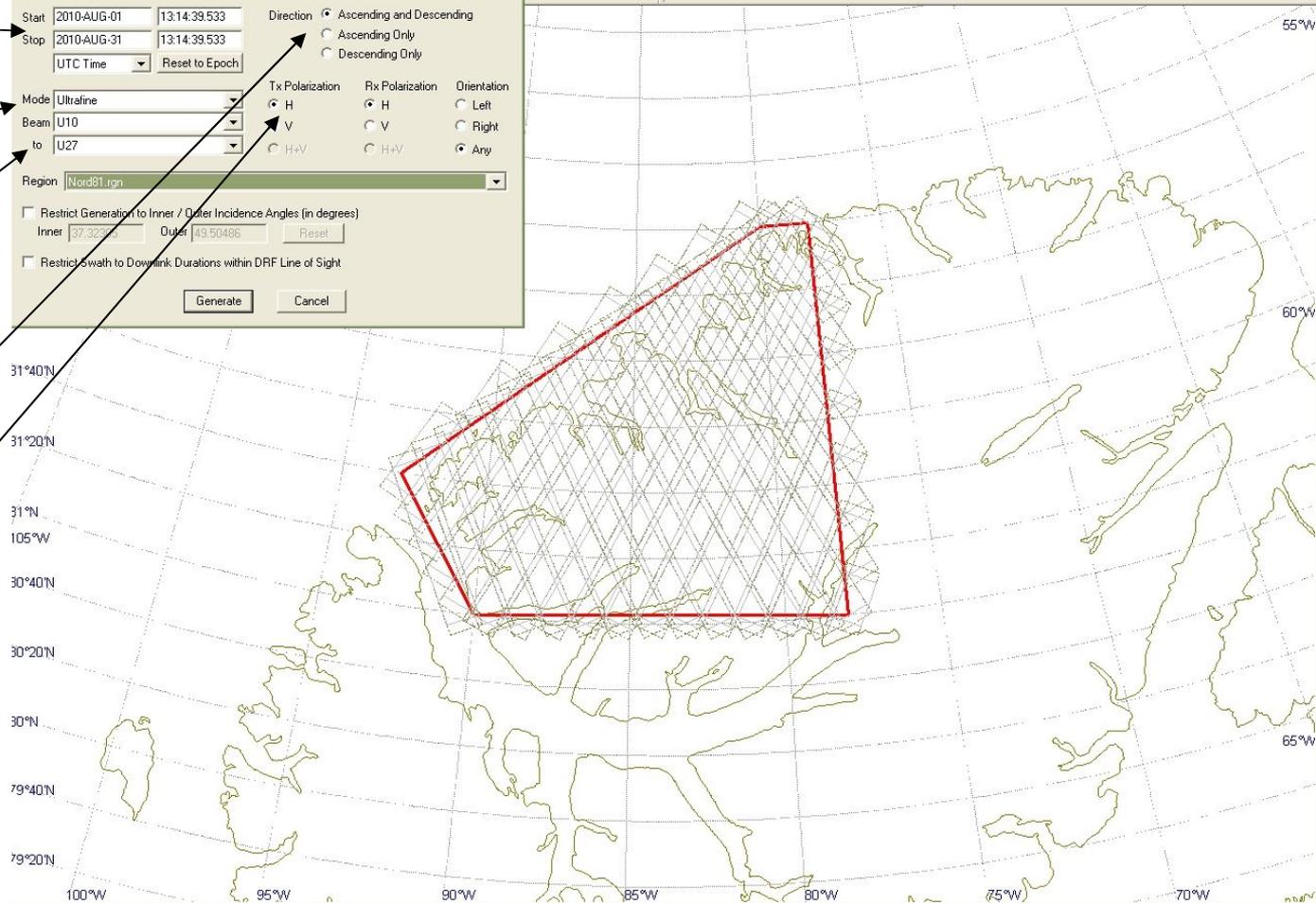
Orientation: Left
 Right
 Any

Region: Nord81.rgn

Restrict Generation to Inner / Outer Incidence Angles (in degrees)
Inner: 37.32335 Outer: 43.50496 Reset

Restrict Swath to Downlink Durations within DRF Line of Sight

Generate Cancel



Date:

Melt season

Mode:

Ultra-Fine (3m)

Beam:

U10 (37°-38°)

U27 (49°-50°)

Orbit direction:

Ascending/Descending)

Polarization:

HH



3D Extraction



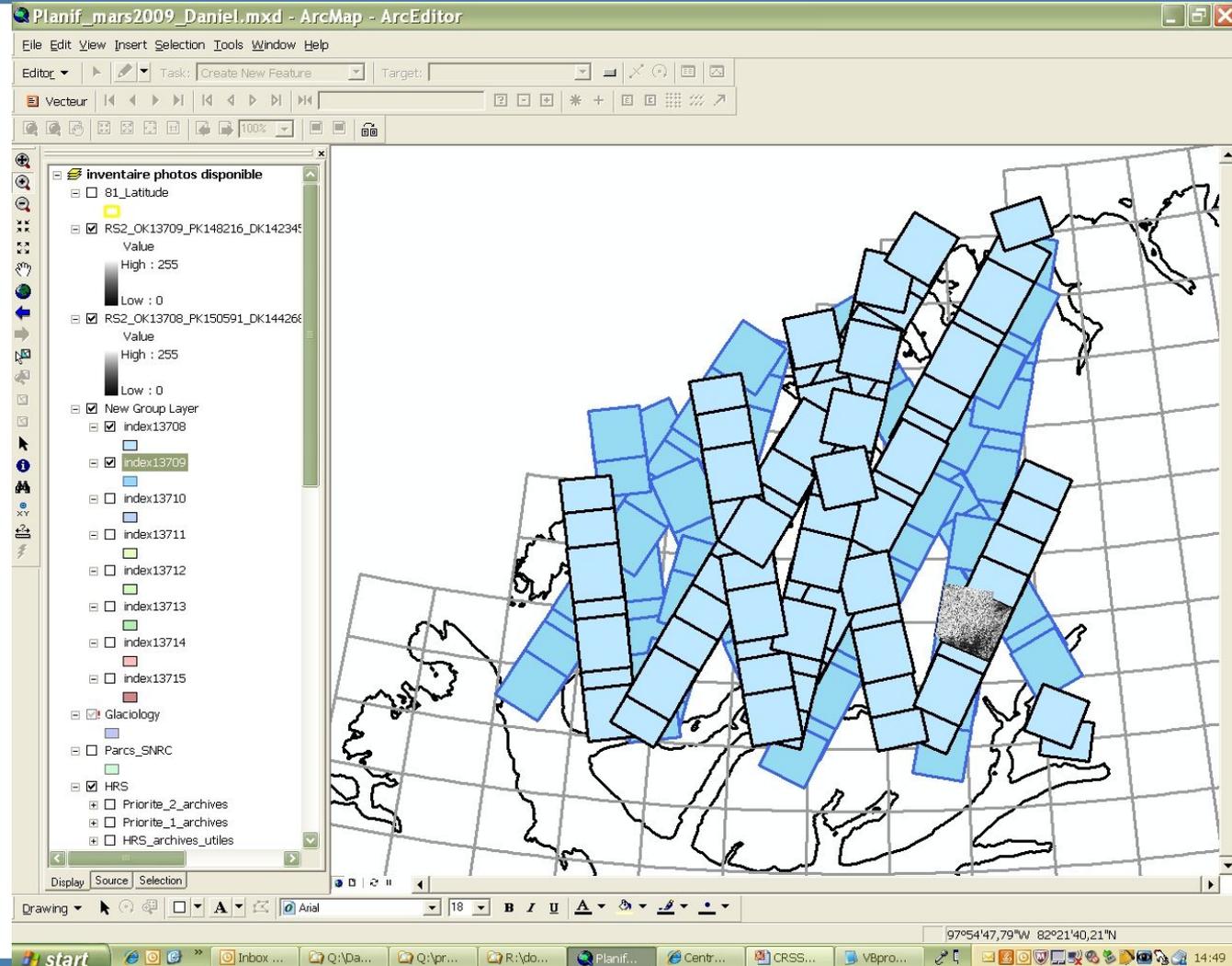
Stéréoscopie radar Directives générales pour l'extraction MNA

Relief Pentes	Plat 0°-10°	Vallonné 10°-30°	Montagneux 30°-50°
Disparité radiométrique	Faible	Moyenne	Grande
Disparité géométrique	Grande	Moyenne	Faible
Compromis	Côté opposé avec de petits angles de visée	Même côté avec un grand angle d'intersection	Même côté avec un petit angle d'intersection et de grands angles de visée
Configurations stéréos RADARSAT	S1 asc - S1 desc 	S7 - S1 (asc ou desc) 	S7 - S4 (asc ou desc)
	F1 asc - F1 desc 	F5 - F1 (asc ou desc) 	F4 - F1 (asc ou desc)

Image Index



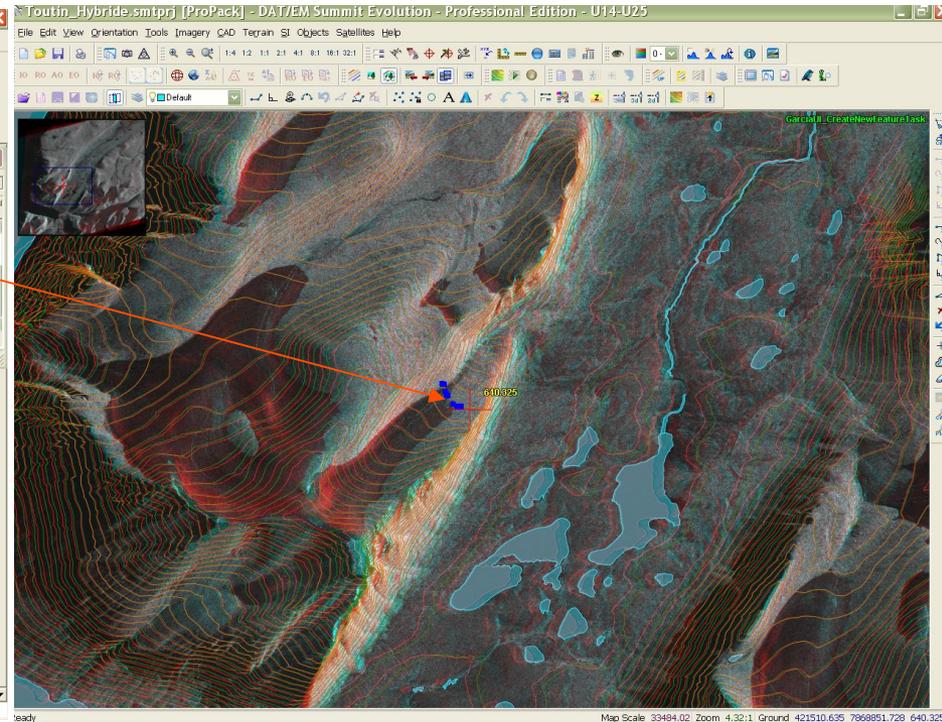
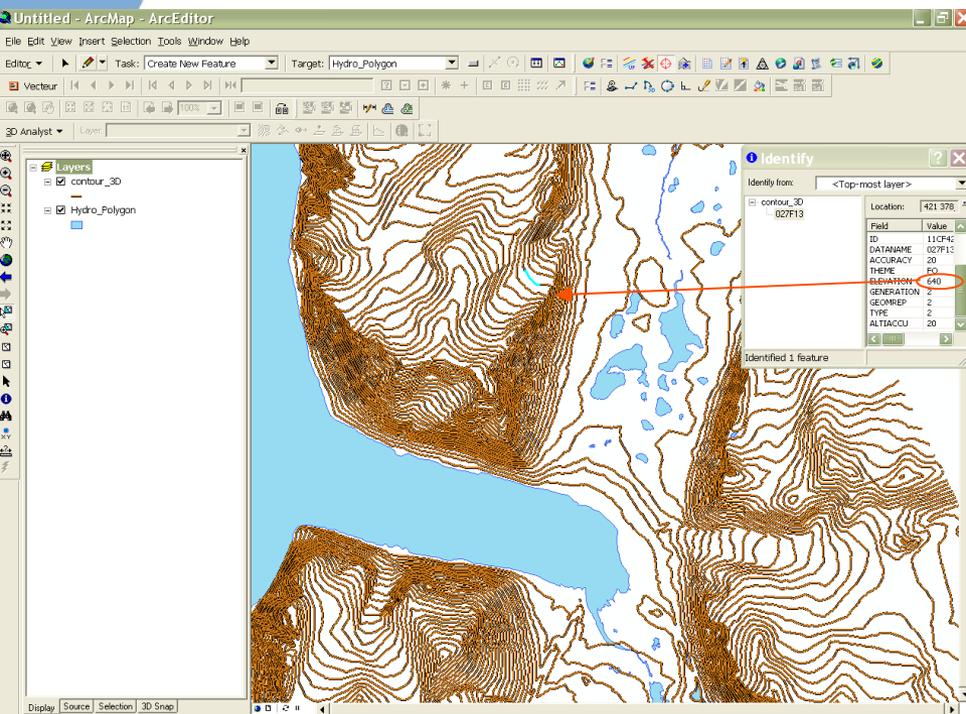
- U10-U27
(37°-48°)
Model



Toutin's Hybrid Model



- Geometric correction without GCP's



1/50,000 scale Vector Data

U10-U27 Stereo model without GCP's



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Model Precision



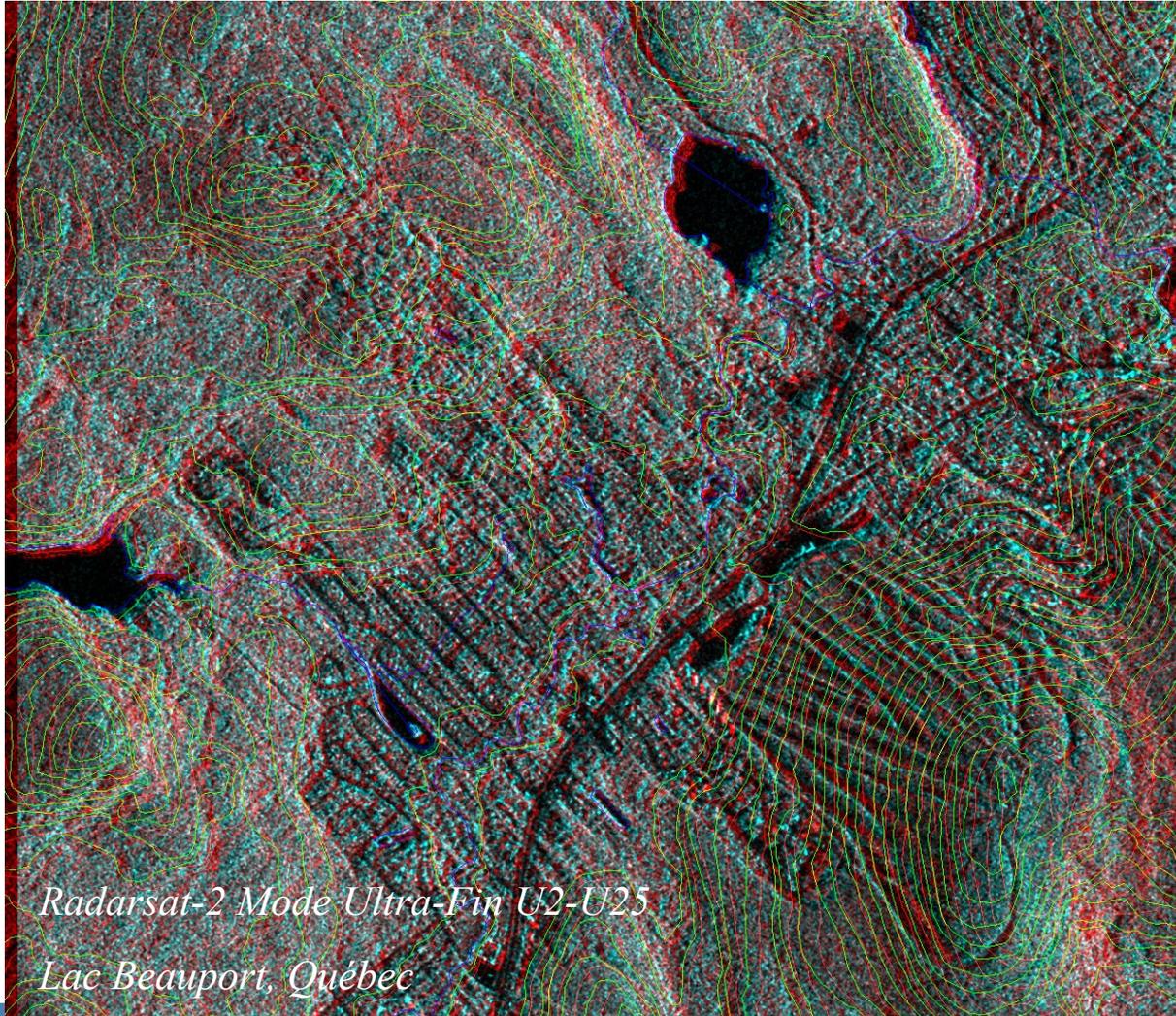
Monoscopic results: errors computed over ICPs

image	ICP	RMSE-X	RMSE-Y	Min X	Max X	Min Y	Max Y
U2	44	2.1	2.2	-5.5	3.5	-5.1	3.7
U25	70	2.2	2.0	-6.5	3.1	-7.0	3.8

Stereoscopic results: errors computed over 44 ICPs

RMSE-X	RMSE-Y	RMSE-Z	Min X	Max X	Min Y	Max Y	Min Z	Max Z
1.1	0.9	2.2	0.3	5.0	0.3	4.5	-5.2	3.2

U2-25 Stereo model with CanVec contours and hydrography



Radarsat-2 Mode Ultra-Fin U2-U25

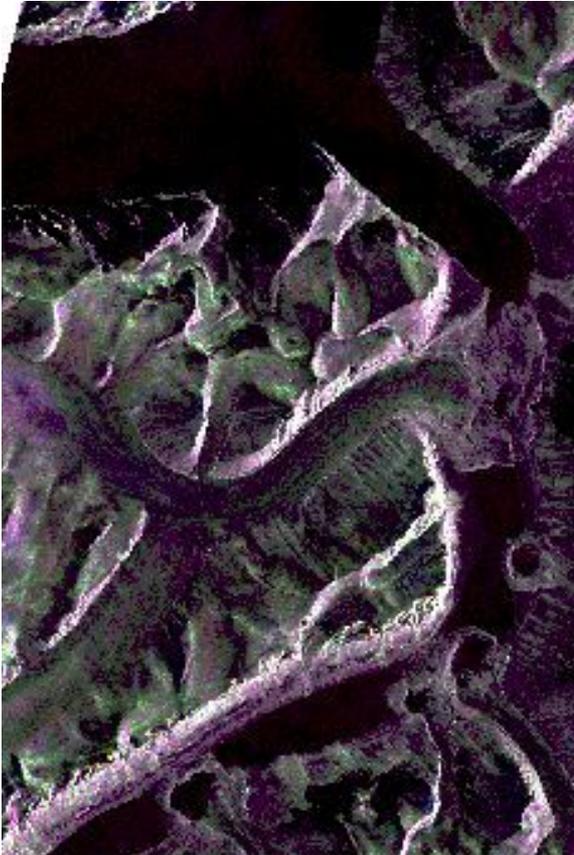
Lac Beauport, Québec



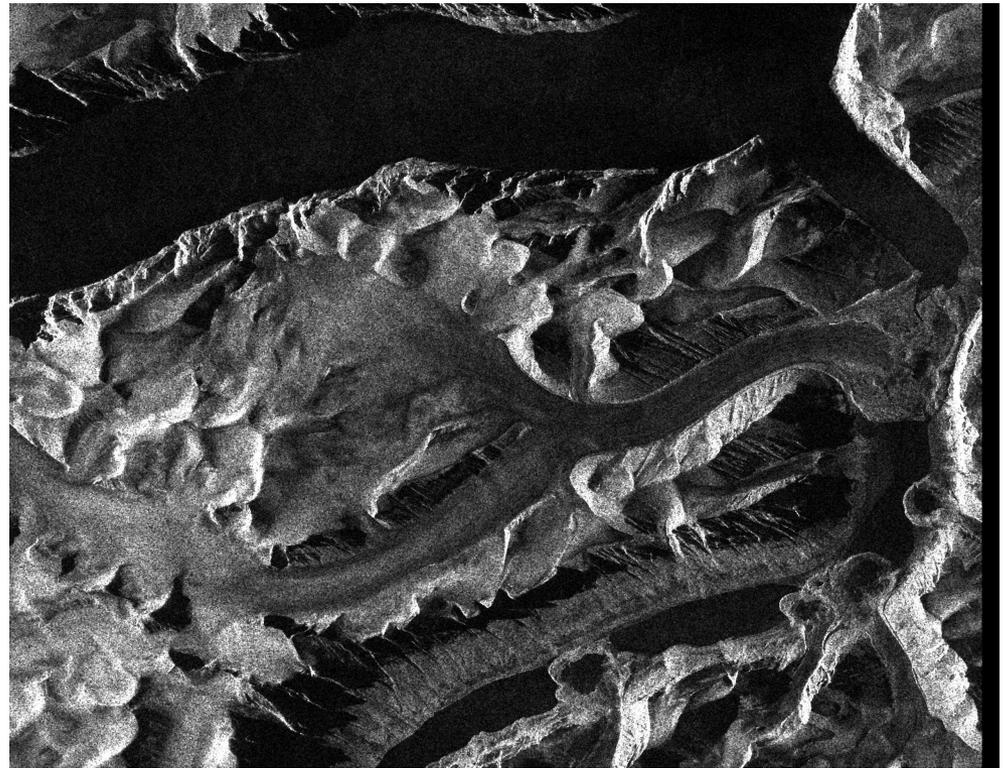
Image Modes Tested



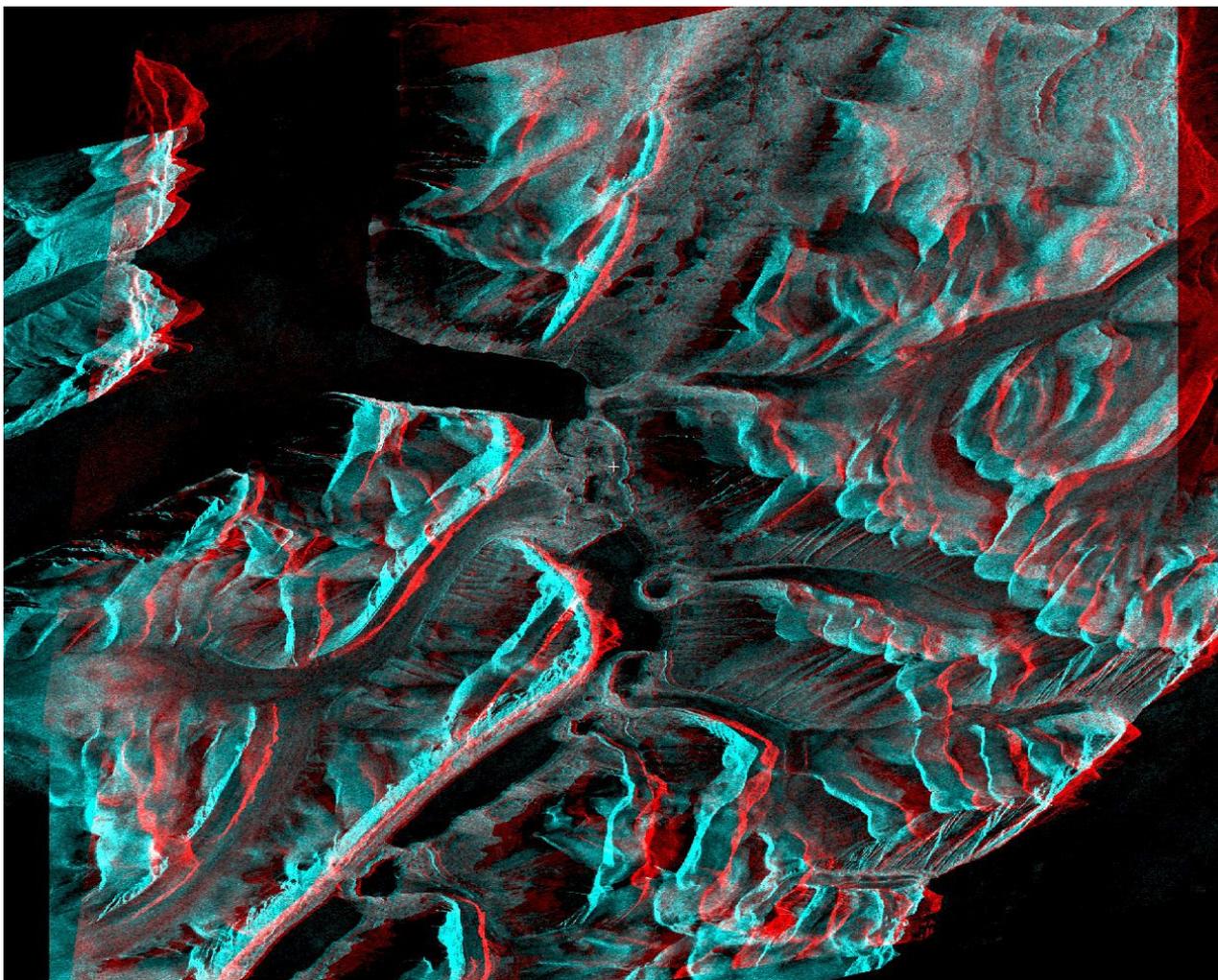
**Radarsat 2 Image, FQ21,
HH, HV, VV**



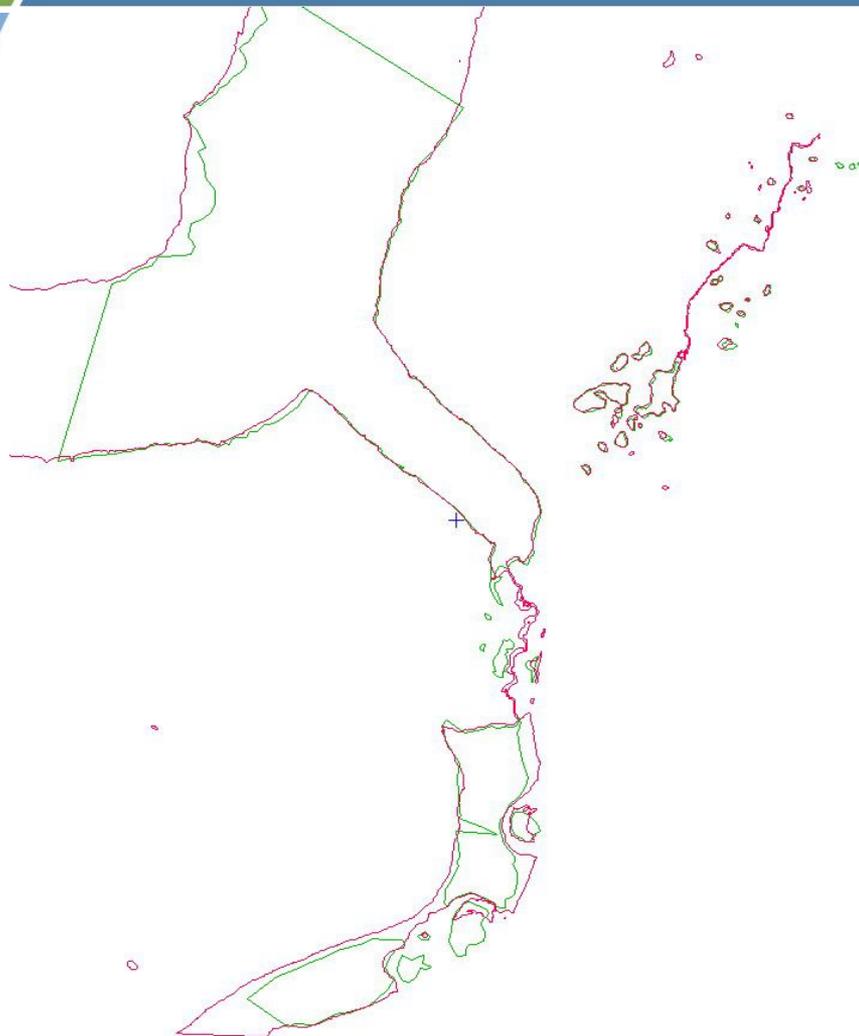
Radarsat 2 Image, U27, VV



FQ8-21 Stereo model



Radarsat-2 / Canvec vectors



Radarsat-2 vectors
(20 metre CE90)



Ground truth vectors

Some statistics...



Planimetric features	3D model content	Detected features	Omissions Nb	Comissions Nb	Conformity Nb	Conformity %	Extraction %
Permanent snow & ice	6	5	1	0	5	100	83,3%
Lakes	119	17	112	2	15	88,2	12,6%
Watercourses	218	32	186	1	31	97	14,3 %
Coastline	2	2	0	0	2	100	100 %
Moraine	1	1	0	0	1	100	100 %

Observations



- 2D or 3D extraction accuracy is in the pixel order (1.5 m RMS in the three axes for the ultra-fine mode)
- DTM generation with Ultra-Fine mode imagery, in low to moderate terrain (slopes < 10 degrees), is 8m LE90
- 3D rendering in mountainous terrain is best achieved with large incidence angles (37-48 degrees)
- Elevation data acquisition is possible in mountainous terrain with ascending/descending orbits and ICESat control.

Conclusion...



- Identification of topographic features that are visible on aerial photography at the approximate scale of 1:60, 000 is possible in Ultra-Fine Mode (3 metre resolution).
- Feature extraction accuracy from Ultra-Fine mode imagery in mountainous terrain meets our 1: 50,000 scale mapping requirements (20 m CE90)

Data availability Canvec CDED



www.geogratis.ca

www.geobase.ca

Natural Resources Canada
www.nrcan.gc.ca

CanVec, Canada

CanVec is a digital cartographic reference product produced by Natural Resources Canada. CanVec originates from the best available data sources covering Canadian territory and offers quality topogr... [more details] [documentation]

Access the [ETP download directory](#) in order to quickly download a large amount of data.

Search Datasets by Name

Dataset Name:

Search Datasets by Spatial Extents [How to navigate?](#)

Scale = 1:15M

Legend:

- New data
- Modified data
- Unchanged data
- No data

Locate an area of interest on the map

Use one of the following location methods in order to limit spatial extents of your search to a specific region of interest.

- by Geoname
- by Postal Code
- by NTS Mapsheet
- by Geographic Coordinates

Date Modified: 2009-07-15 [Top of Page](#) [Important Notices](#)

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Data

Data Selection

Click on the map to select a region

Legend:

- 5500m Available
- 1000m Available
- 0m Available
- Unavailable

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Last updated: 2008-03-05



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Thank you

