Paul Morin

Sub-meter Commercial Imagery

Orthomosaics, DEMs and Raw Imagery

Morin-01

Paul Morin, Claire Porter

and Cole Kelleher

Institutional Collaborations

- National Science Foundation, National Geospatial-Intelligence Agency, United States Geological Survey.
- Geological and Geographic Surveys of Canada, Iceland, Greenland, Denmark, Norway, Sweden, Finland and Russia.
- State of Alaska, Geographic Information Network of Alaska.
- ESRI and Google

And… but… therefore

The Polar Geospatial Center is a science support organization that provides sub-meter optical imagery to the federally funded science community.

PGC has the capability to task, process and deliver sub-meter value added products for large geographic areas. We are providing commercial imagery and expertise to support ABoVE science.

Spaceborne Remote Sensing

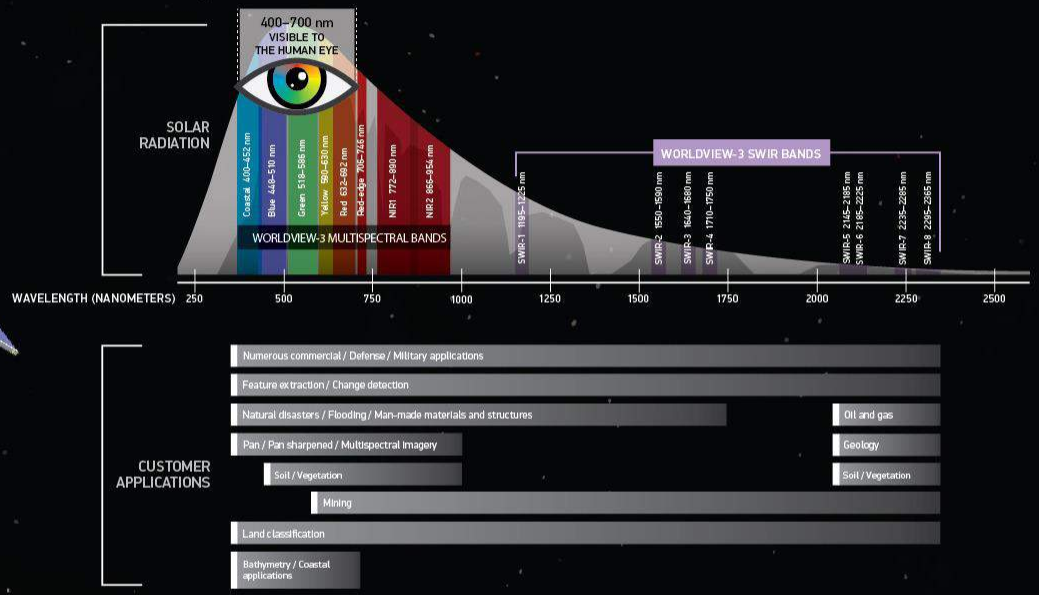
- Collection starting in 1999 with Ikonos
- Entire QuickBird and Ikonos Archives will be available.
- WorldView-1,2 and 3 Currently collecting stereo imagery of the ABoVE domain and the entire arctic.
- Complete mono coverage of the Arctic.
- Stereo coverage is >85%.
- Imagery is licensed for US Government Purposes

Introducing the first multi-payload, super-spectral, high-resolution commercial satellite ever to be launched.

WorldView-3

DigitalGlobe

- Panchromatic
- Daily revisit
- 8-Band multispectral
- Rapid retarget CMGs
- 8-Band short wave infrared

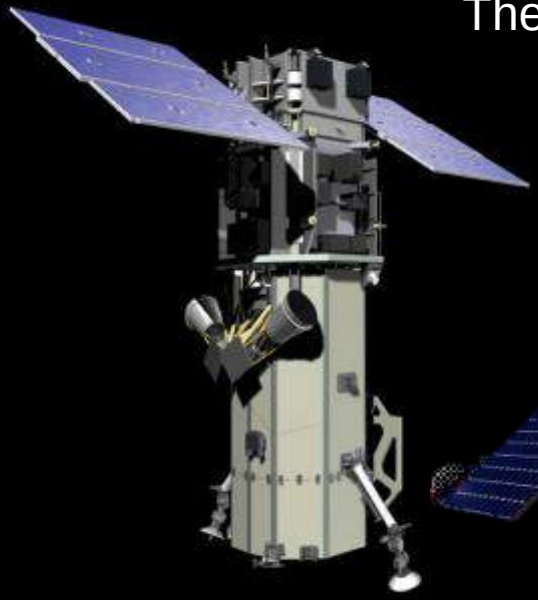


Get the best imagery and information available from the most advanced constellation.

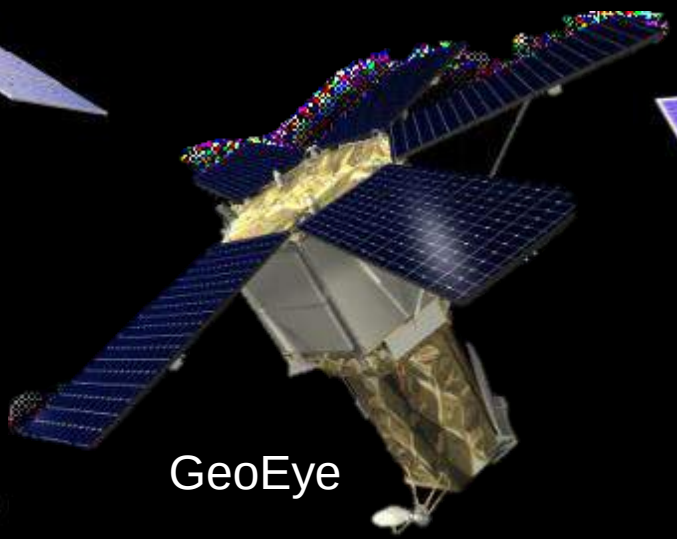
	Accuracy w/o GCP	Pan resolution	Multispectral resolution	SWIR resolution	Spectral characteristics	Swath width (nadir)	Operational altitude	Average revisit	Capacity (km²/day)	Onboard storage
IKONOS	15 m CE90	1.0 m	4.0 m	NA	Panchromatic 4-Band Multispectral	11.3 km	681 km	3 days	150,000	64 Gb
QuickBird	23 m CE90	65 cm	2.62 m	NA	Panchromatic 4-Band Multispectral	18 km	482 km	2.7 days	210,000	128 Gb
WorldView-1	< 3 m CE90	50 cm	NA	NA	Panchromatic	17.7 km	496 km	1.7 days	1.3 million	2199 Gb
GeoEye-1	5 m CE90	50 cm	2.0 m	NA	Panchromatic 4-Band Multispectral	15.2 km	681 km	< 3 days	1 million	1 Tb
WorldView-2	< 3 m CE90	46 cm	1.85 m	NA	Panchromatic 8-Band Multispectral	16.4 km	770 km	1.1 days	1.1 million	2199 Gb
WorldView-3 2014 expected launch	< 3 m CE90	31 cm	1.24 m	3.7 m	Panchromatic 8-Band Multispectral 8 SWIR Bands	13.2 km	617 km	< 1 day	680,000	2199 Gb

Discover more at digitalglobe.com/WorldView3

The DigitalGlobe Satellite Constallation

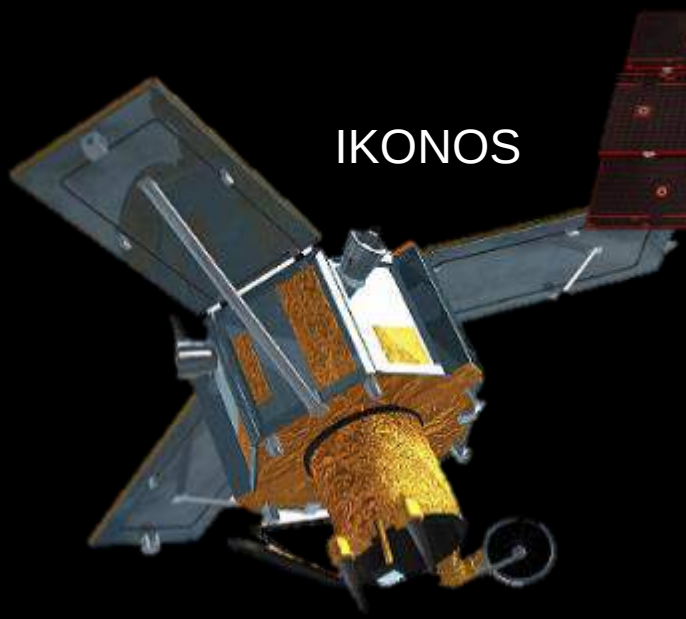


WorldView-2

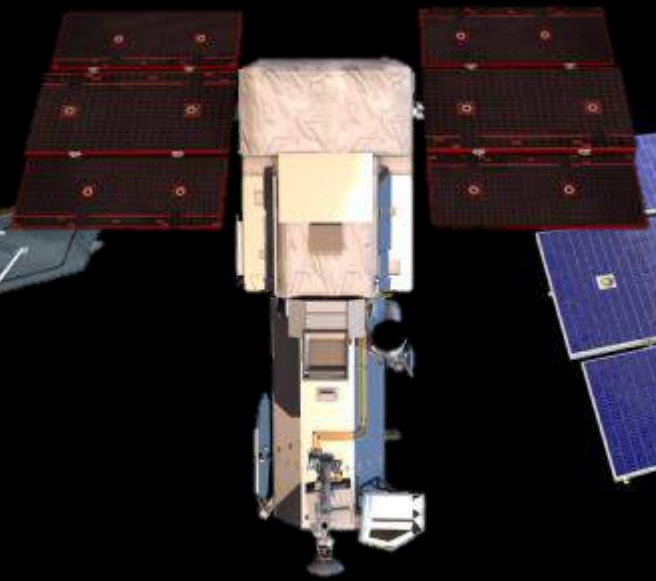


GeoEye

QuickBird



IKONOS

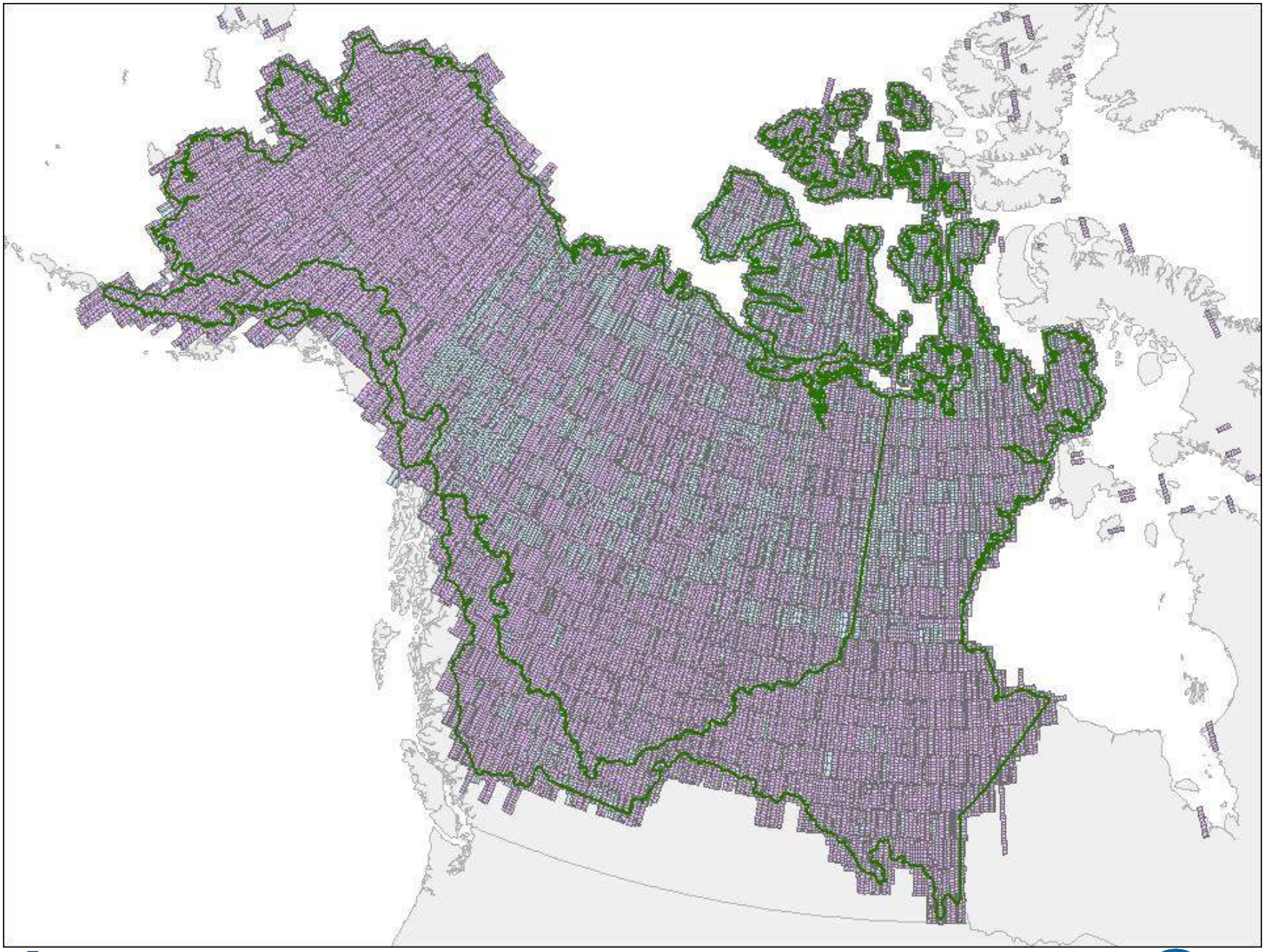


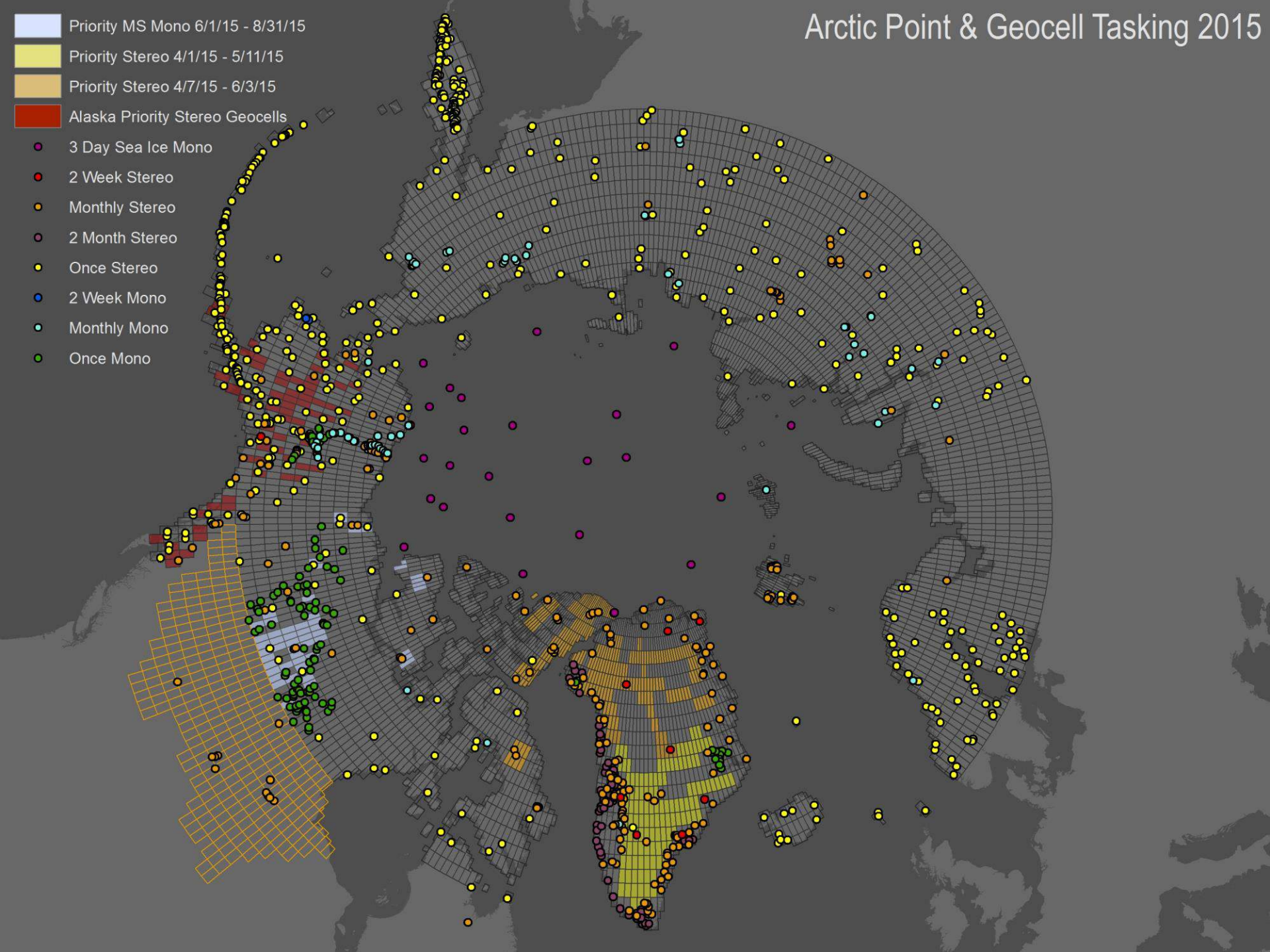
WorldView-3

WorldView-1

Geospatial Data Products

- Sub-meter panchromatic orthomosaic of the Arctic
- 2m posting Elevation models of the Arctic
- Temporal range
  - Mono 1999-today
  - Stereo 2011-today
- Stakeholder / user base: Very Large
- Data available from the ABoVE science cloud




Arctic Point & Geocell Tasking 2015
Priority MS Mono 6/1/15 - 8/31/15
Priority Stereo 4/1/15 - 5/11/15
Priority Stereo 4/7/15 - 6/3/15
Alaska Priority Stereo Geocells
3 Day Sea Ice Mono
2 Week Stereo
Monthly Stereo
2 Month Stereo
Once Stereo
2 Week Mono
Monthly Mono
Once Mono

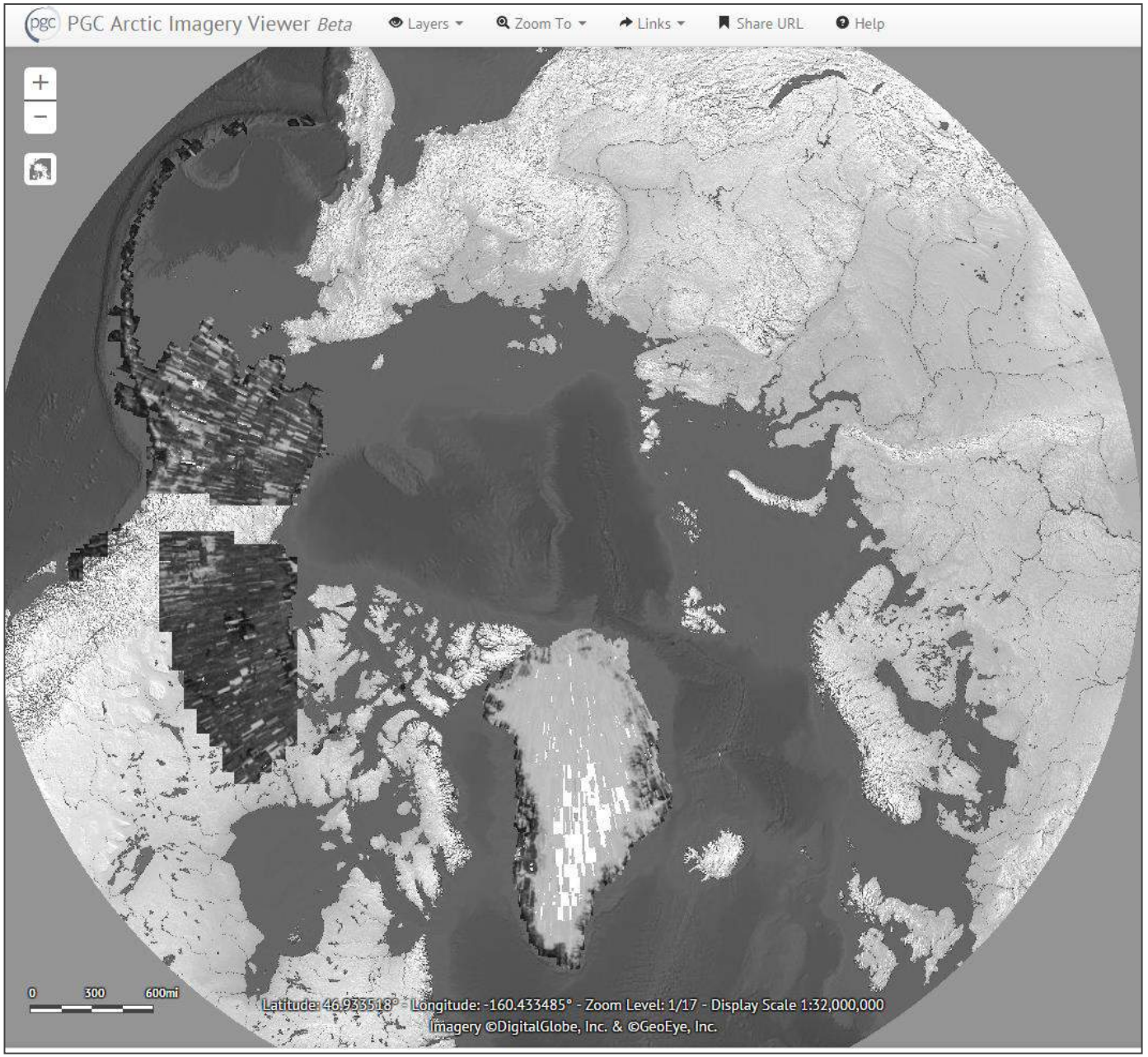
Archive and Tasking

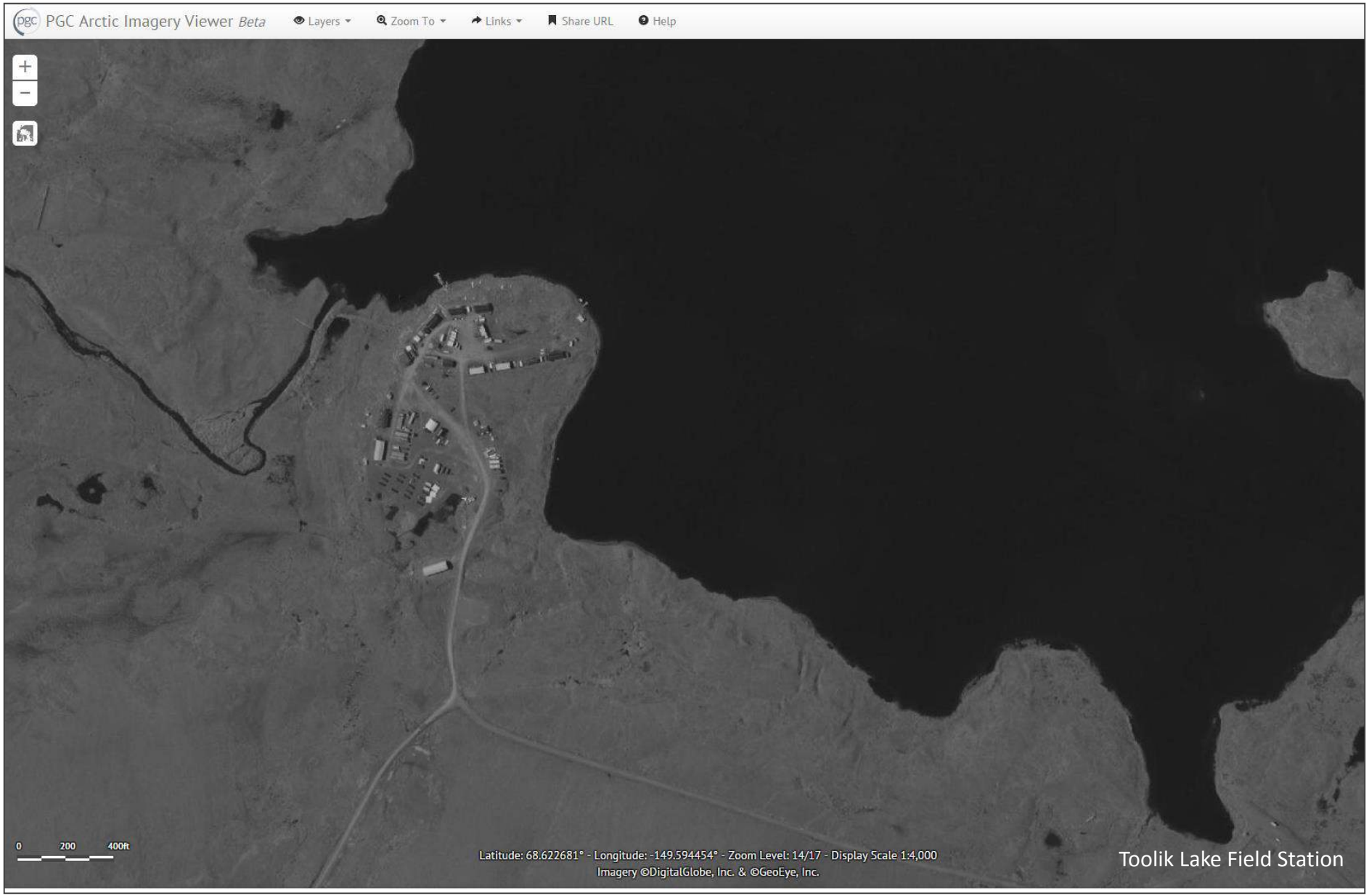
Commercial EO Imagery Archive

- 79,259 unique strips (cloudcover<20)
- 54,585 (70%) on the ADAPT systems
- 216 TB Total Arctic Imagery now at ADAPT

Tasking - Contact Liz Hoy

- Burns
- Flux towers
- Facilities


PGC Arctic Imagery Viewer Beta
Layers
Zoom To
Links
Share URL
Help
0
300
600mi
Latitude: 46.933518° - Longitude: -160.433485° - Zoom Level: 1/17 - Display Scale 1:32,000,000
Imagery ©DigitalGlobe, Inc. & ©GeoEye, Inc.

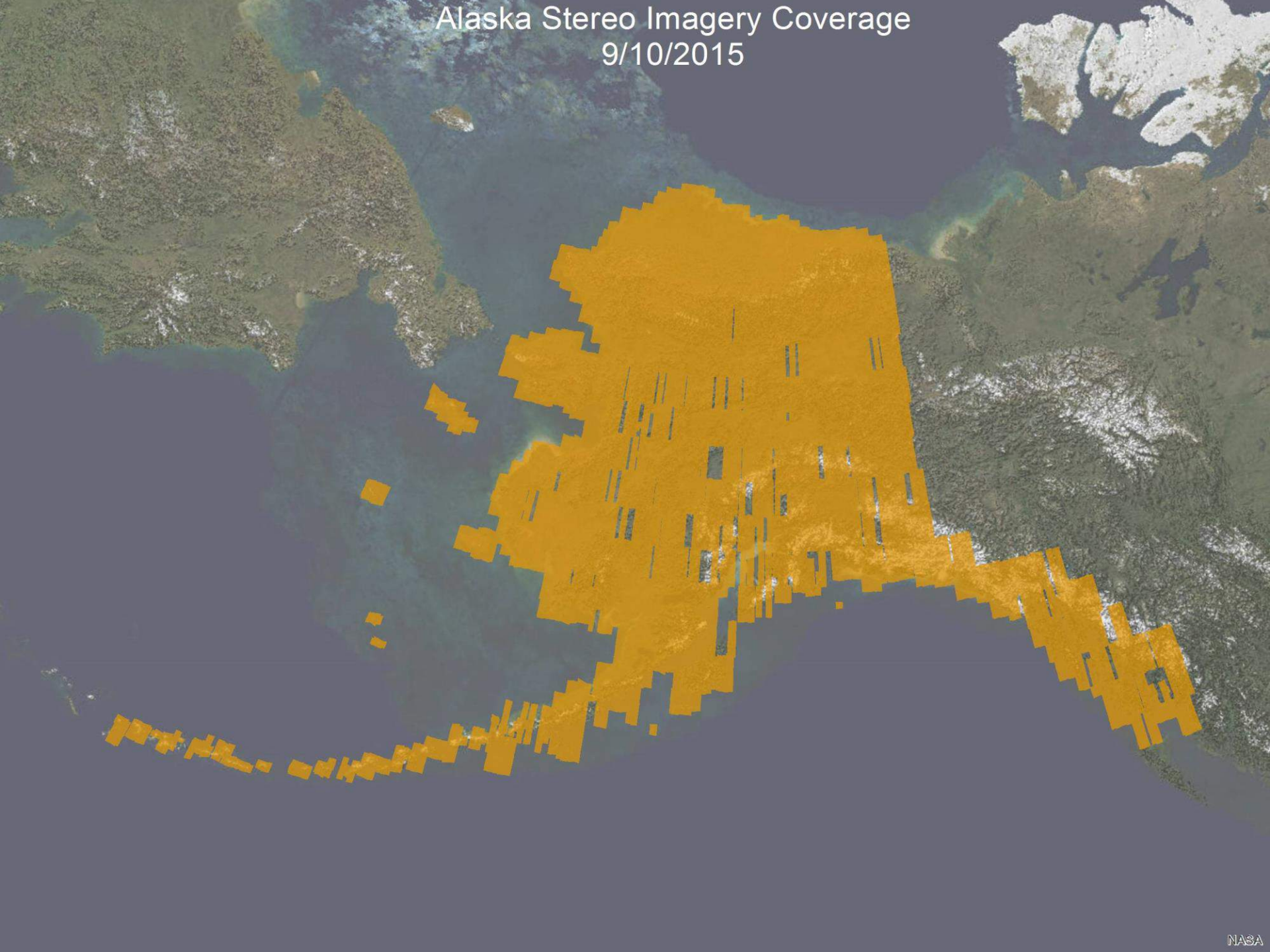

PGC Arctic Imagery Viewer Beta
Layers
Zoom To
Links
Share URL
Help
0
200
400ft
Latitude: 68.622681° - Longitude: -149.594454° - Zoom Level: 14/17 - Display Scale 1:4,000
Imagery ©DigitalGlobe, Inc. & ©GeoEye, Inc.
Toolik Lake Field Station

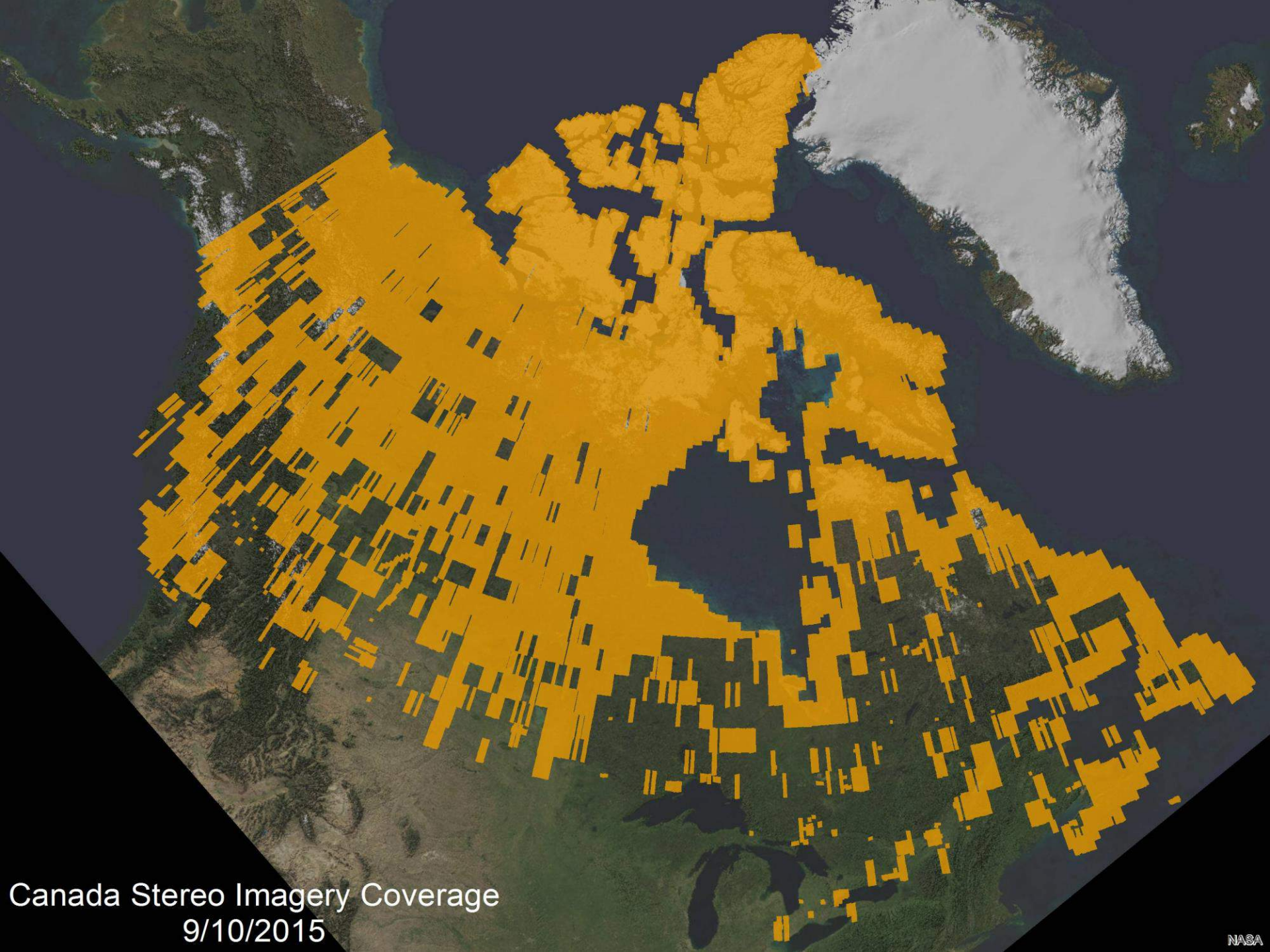
Geospatial Data Products

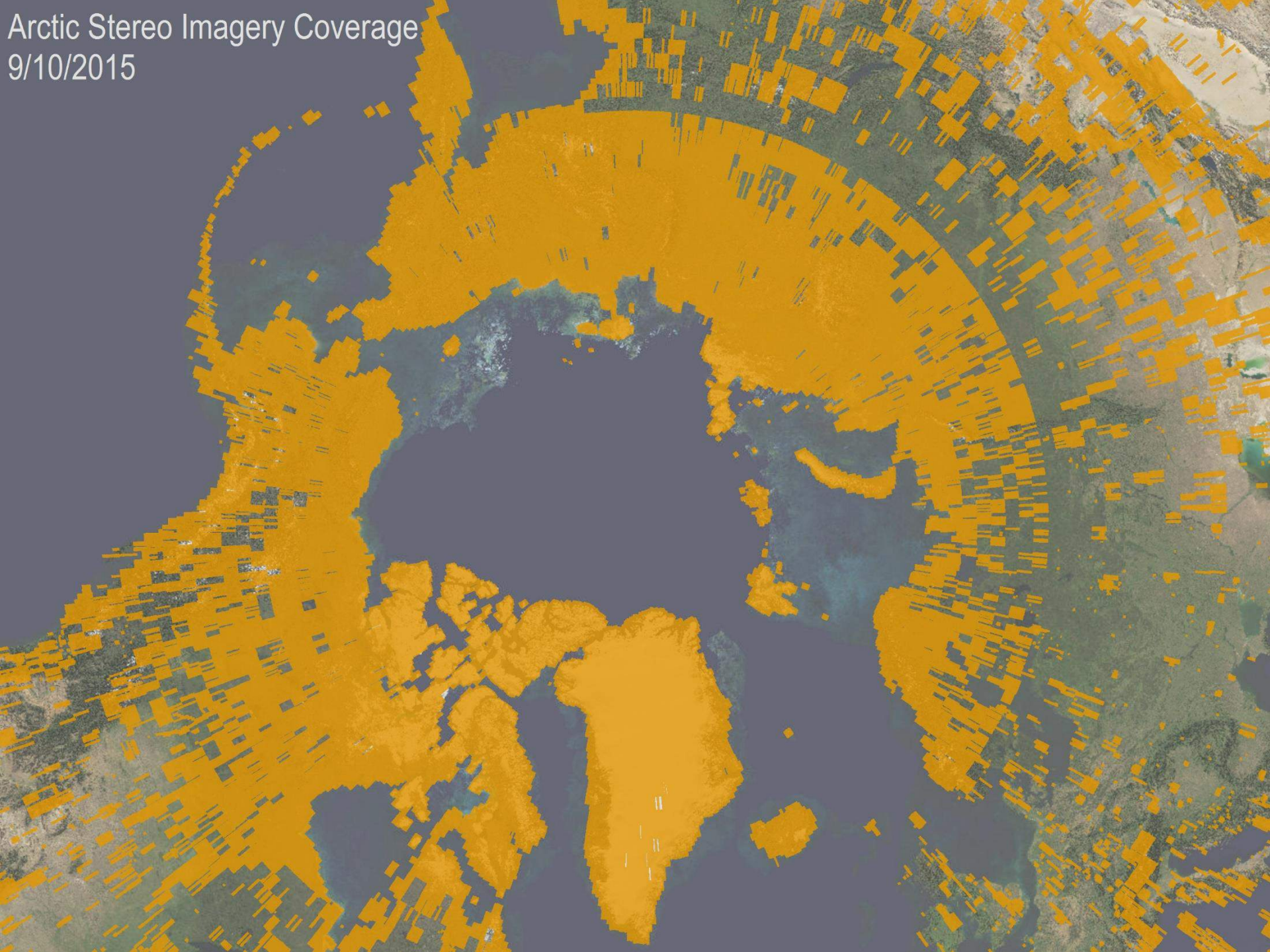
- ArcticDEM
  - NSF and NGA are supporting the development a publically available DEM of the arctic
  - PGC will process all stereo for the entire ABoVE domain.
    - Only about 50% of the ABoVE domain south of 60N has stereo. Collection continues.
    - Alaska mosaic by mid 2016. Arctic mosaic by spring 2017
    - DEM strips will be continuously produced. Delivery TBD.

Geospatial Data Products

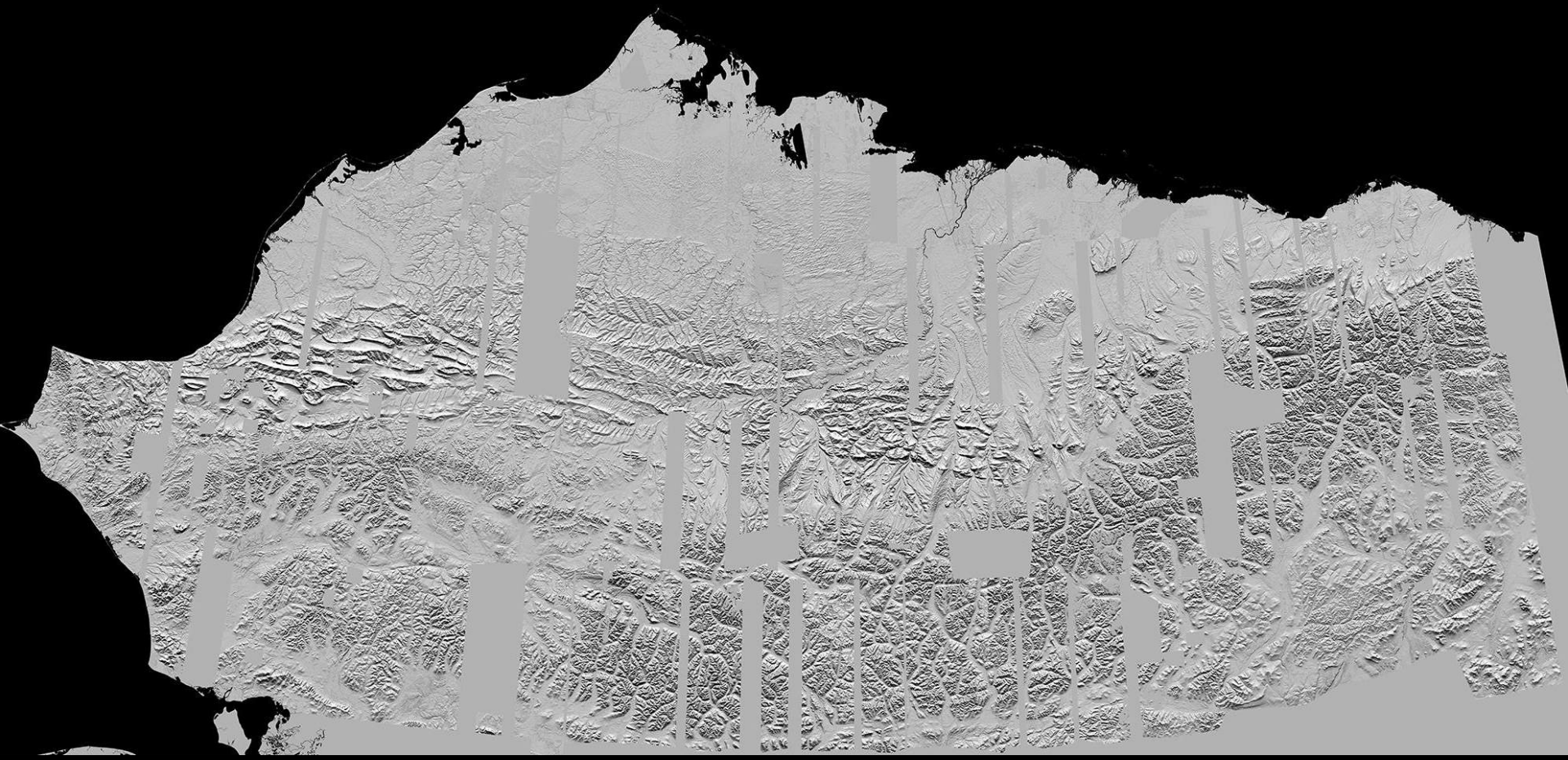
- Imagery
  - All arctic imagery on the way to the ABoVE cloud
  - Mosaic for Alaska done
  - Canada underway
  - Rest of Arctic by end 2015


Alaska Stereo Imagery Coverage
9/10/2015
NASA

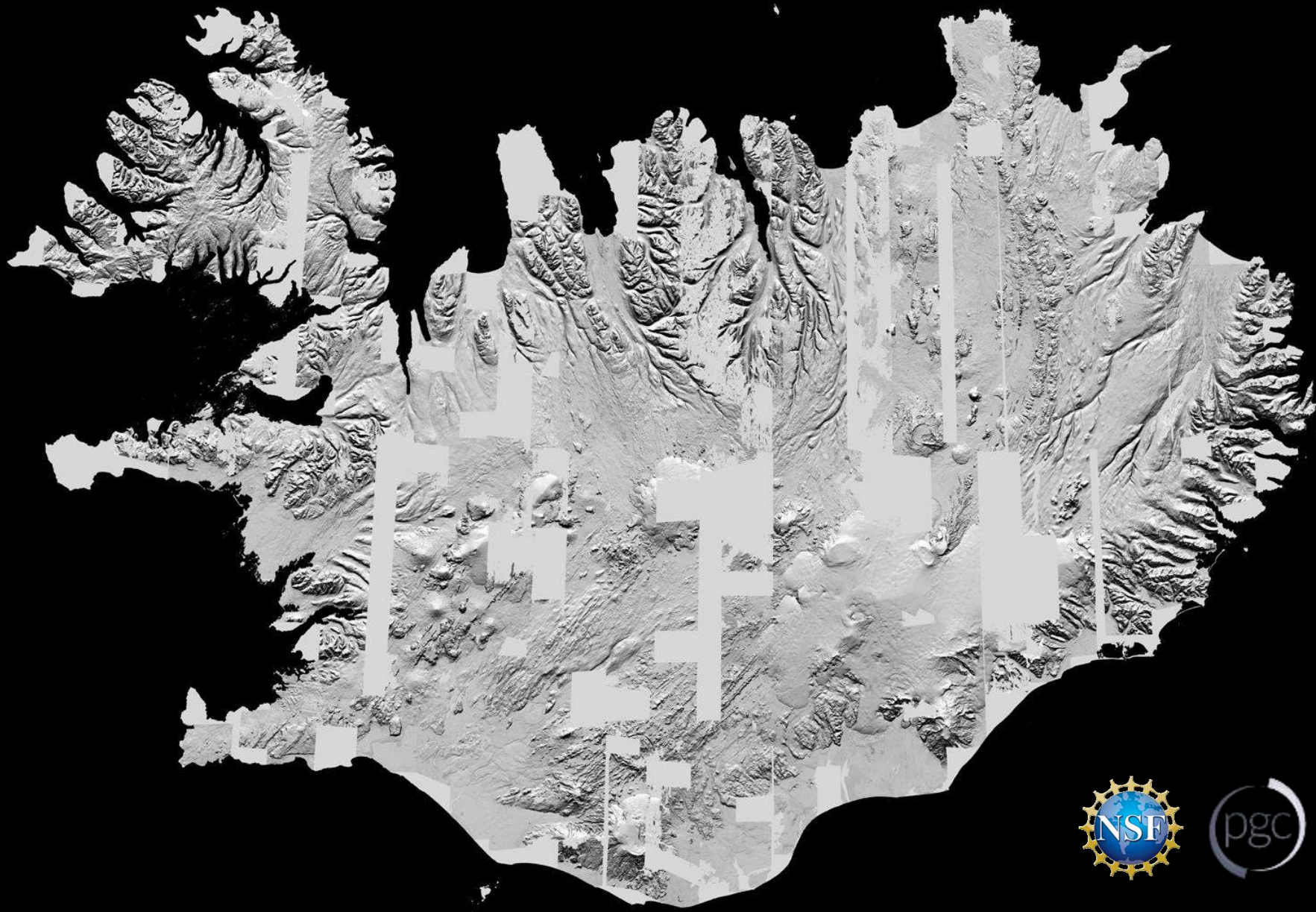

Canada Stereo Imagery Coverage
9/10/2015
NASA


Arctic Stereo Imagery Coverage
9/10/2015

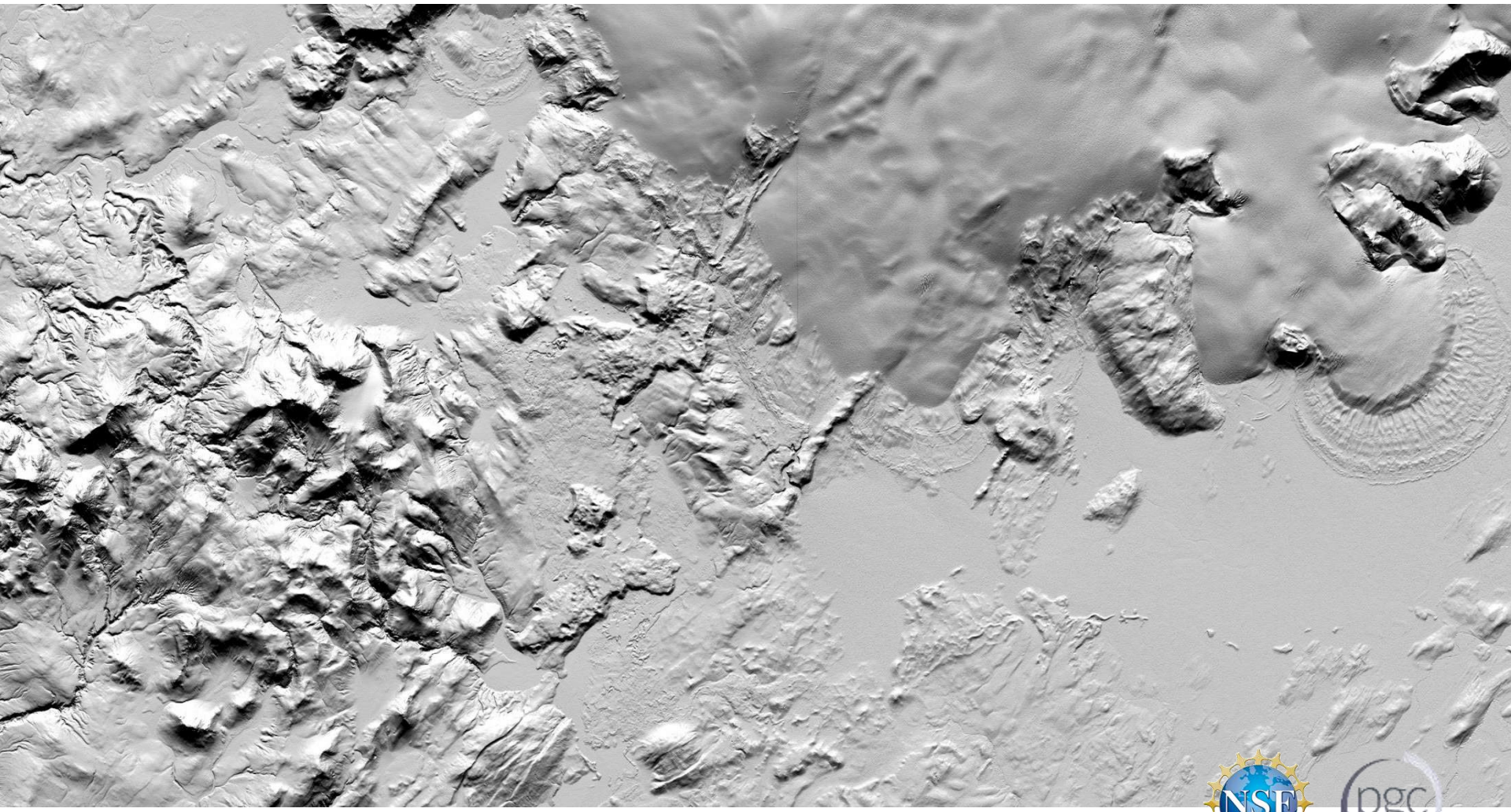
Alaska: Two Meter Resolution Test



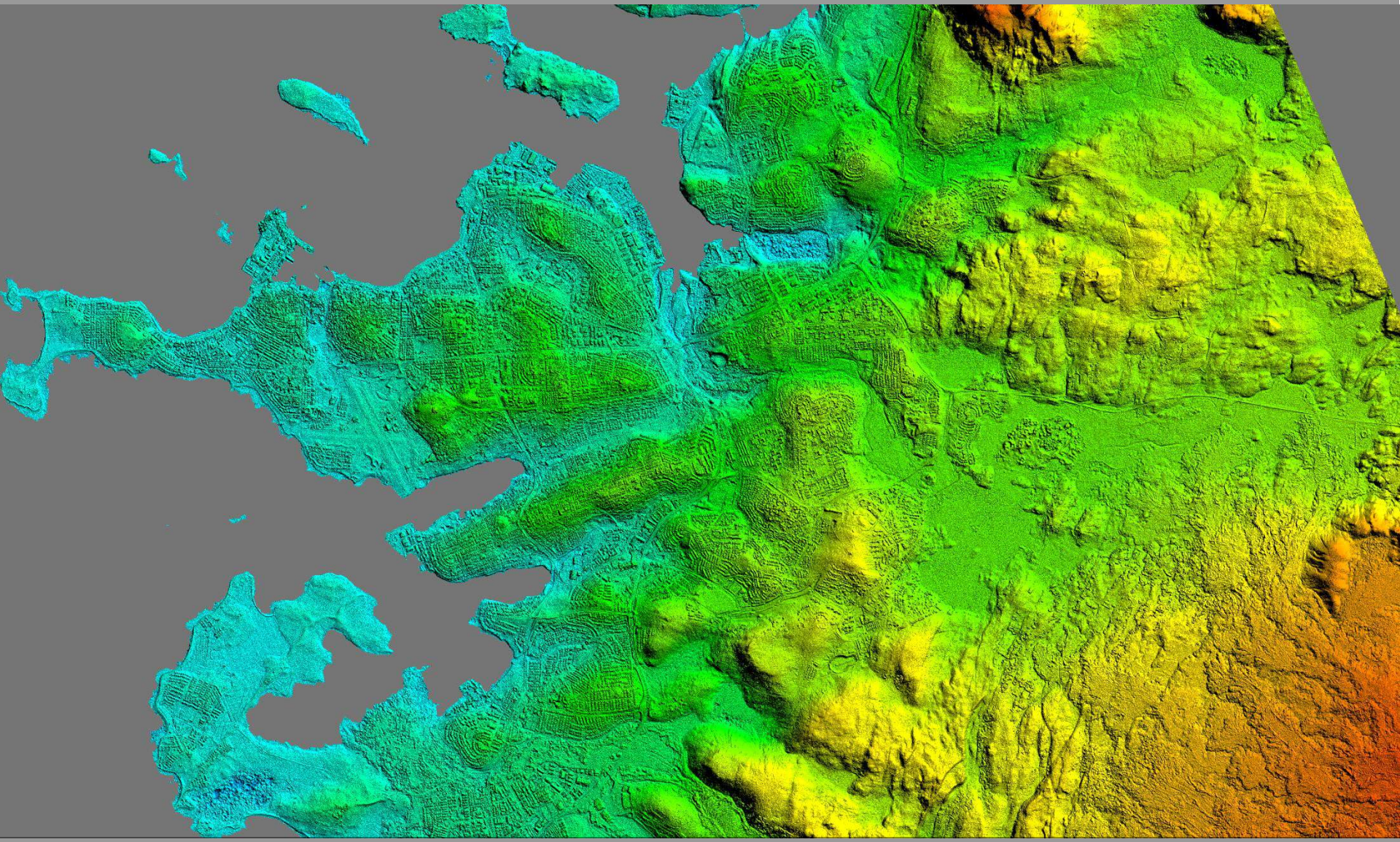
Iceland 2m Test



Iceland 2m Test



Reykjavik, Iceland – 2m Digital Surface Model



Coastline provided by the National Land Survey of Iceland, delivered by Tómas Jóhannesson of the Icelandic Met Office

Elevation derived using Surface Extraction with TIN-based Search-space Minimization (SETSM) – M.J. Noh and Ian Howat (Ohio State University)

How we can use airborne

LIDAR for ground control

ArcticDEM Expected Accuracy

- Without ground control
  - Dependent on the sensor's Rational Polynomial Coefficients (RPC) accuracy
  - WorldView 1 & 2 DTMs have a horizontal positional accuracy of **4m** CE90
- Using NASA Operation IceBridge LiDAR
  - Point accuracy of 0.20-0.35 m (1 standard deviation – accuracy of lidar or DEM after registration)
- Ground-survey (e.g. GPS benchmark) control points not yet employed, but tests show similar accuracy to LIDAR

Myoung-Jong Noh & Ian M. Howat (2015): Automated stereo-photogrammetric DEM generation at high latitudes: Surface Extraction with TIN-based Search-space Minimization (SETSM) validation and demonstration over glaciated regions, GIScience & Remote Sensing, DOI:10.1080/15481603.2015.1008621

Sub-meter Imagery Takeaway

Lots and lots and lots of imagery

An sub-meter arctic mosaic is in production

ArcticDEM is inevitable

Imagery available through the ABoVE Cloud

Contact *Liz Hoy* for tasking, licensing and general commercial imagery information