Cyberinfrastructure, GIS and Remote Sensing

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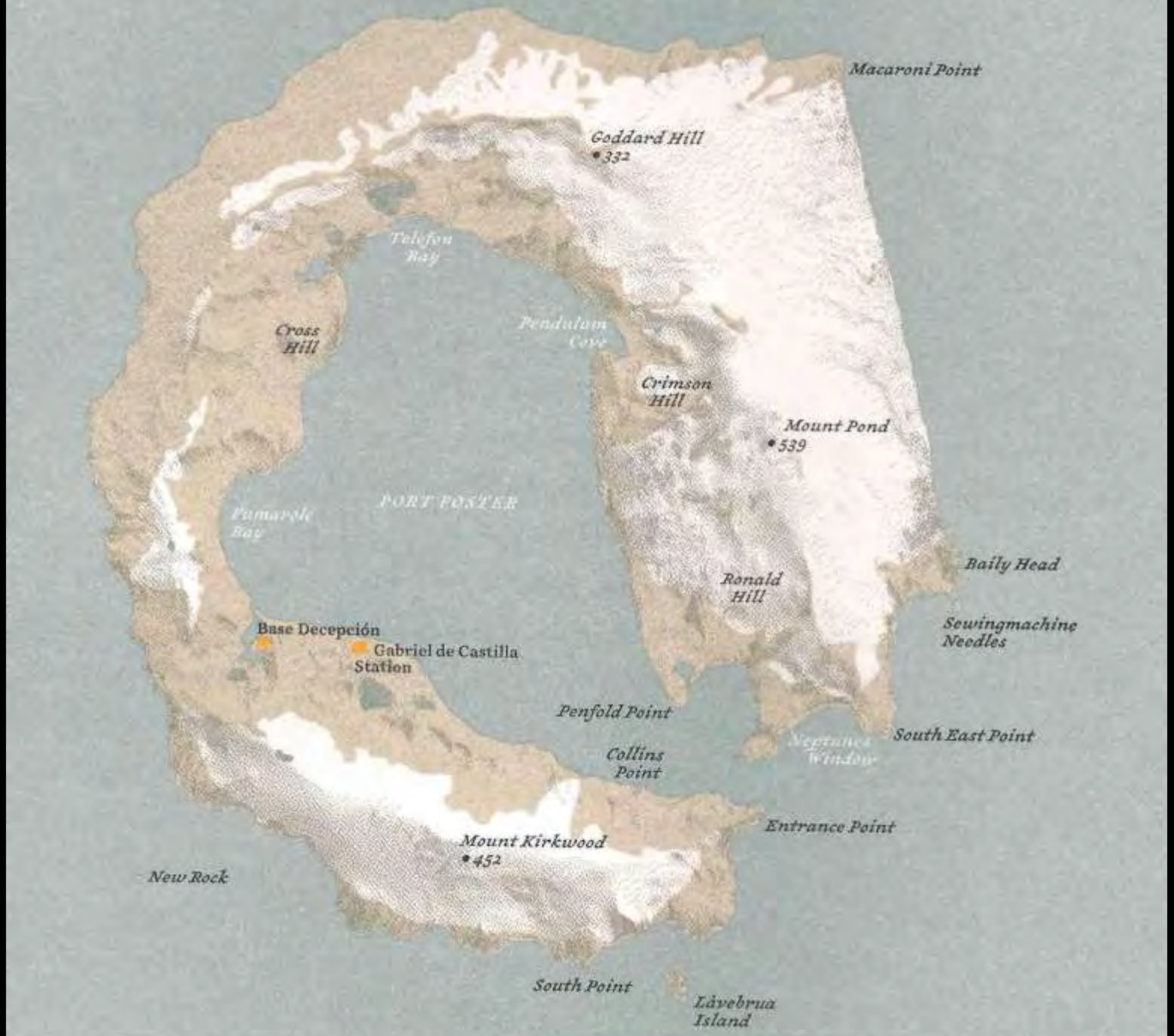
Image: Moshniy Glacier, Russia, August 29, 2012


Palmer Station
Amundsen - Scott
South Pole Station
McMurdo Station
500 Miles
Antarctica
Permanent US Stations
Polar Geospatial Center


Antarctica
Antarctica: 5.4 million mi² (14.0 million km²)
Contiguous 48 States: 3.7 million mi² (9.6 million km²)
Blended Satellite Images (LIMA, Modis, and Radarsat)
Polar Geospatial Center


Macaroni Point
Goddard Hill
• 332
Telefon Bay
Cross Hill
Pendulum Cove
Crimson Hill
Mount Pond
• 539
PORT FOSTER
Pumarejo Bay
Baily Head
Ronald Hill
Sewingmachine Needles
Base Decepción
Gabriel de Castilla Station
Penfold Point
South East Point
Neptune's Window
Collins Point
Entrance Point
Mount Kirkwood
• 452
New Rock
South Point
Livingston Island

3202

WHALERS BAY AND APPROACHES

SCALE 1:12 500

Projection — Gnomonic

Tidal Streams

Lat. 60° 33·07' S.
Long. 60° 33·07' W.

West-going Stream.
Commences 10 minutes after L.W.
Spring Rate 1½ kns. 2 hrs. before H.W.

East-going Stream.
Commences 10 minutes after H.W.
Spring Rate 1½ kns. 4 hrs. after H.W.

Raven Rock
5.0 Metres
62 59.72 LMG
060° 33.32

62 59.74 GPS by Zodiac
060° 33.31

WHALERS BAY

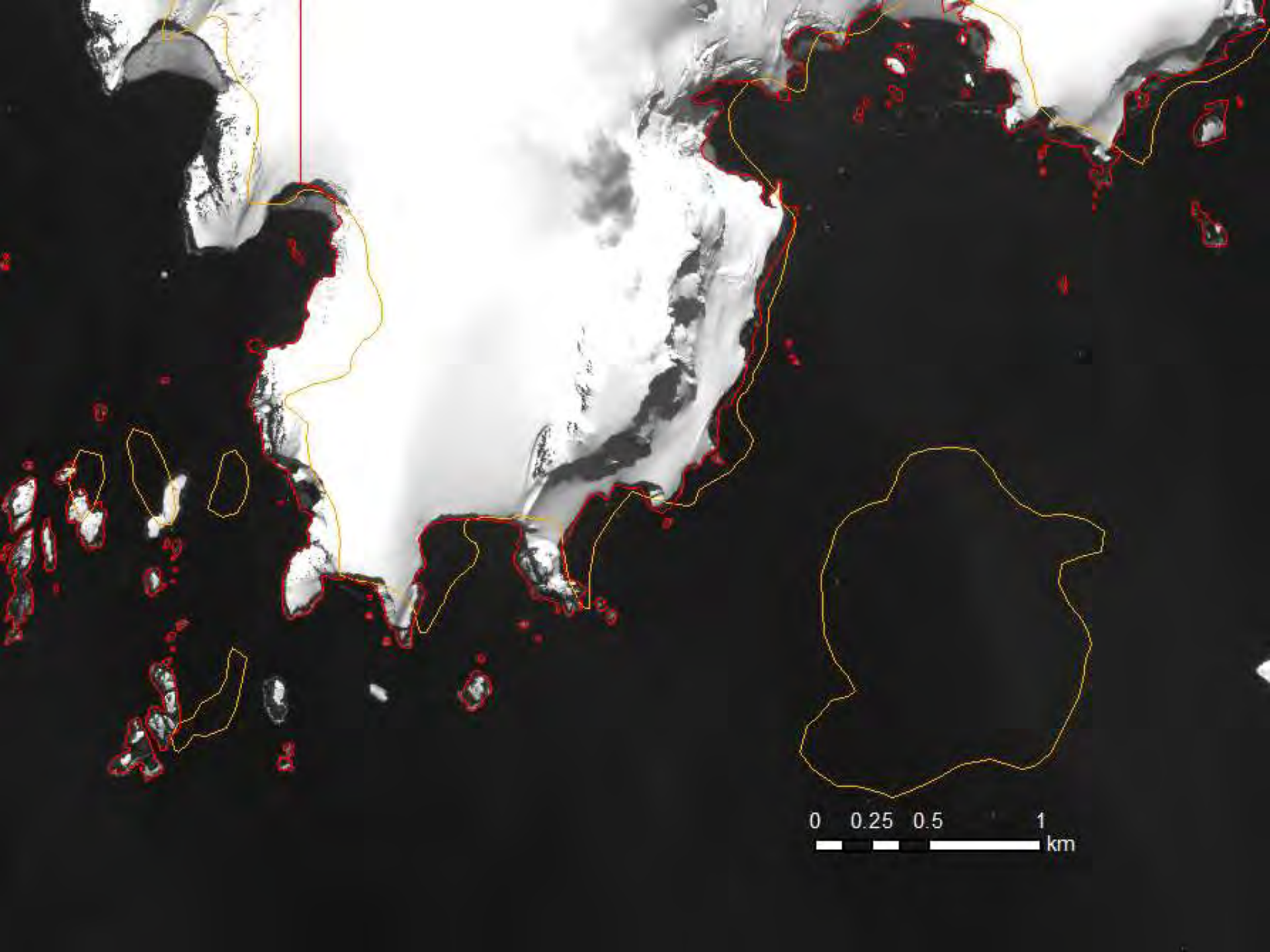
PORT FOSTER

Kroner Lake

NEPTUNES BELLOWS

5.0

291


0 0.25 0.5 1
km


GILLIGAN'S
ISLAND

Polar GIS Issues

Antarctica

- 50 Nations have signed the treaty – 8 have territorial claims
- GIS data is public but poor
- First LANDSAT mosaic was produced in 2008

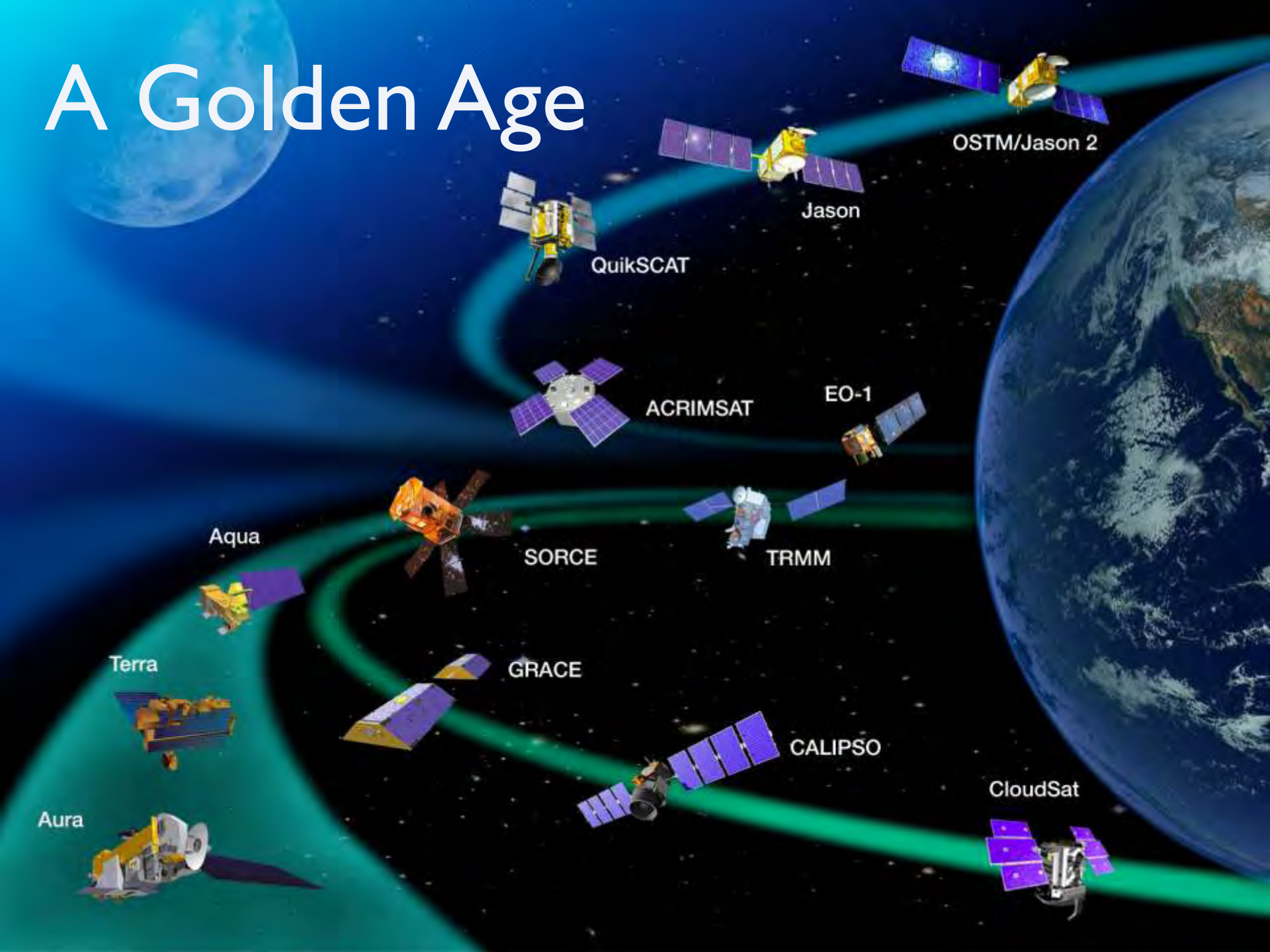
Arctic

- Sovereign Territory
- GIS data is Public/Private/Commercial
- Sovereign Territory of 8 Nations
- The Alaska Problem (>20 agencies producing data)

Overriding issues:

- **Poor elevation data**
- **No consistent, publically available high-resolution imagery**

A Golden Age


OSTM/Jason 2
Jason
QuikSCAT
ACRIMSAT
EO-1
Aqua
SORCE
TRMM
Terra
GRACE
CALIPSO
CloudSat
Aura

Modality Comparison

RADAR

RADARSAT-2
TerraSAR-X
COSCO-SkyMed

Medium/Low Resolution Optical

MODIS
LANDSAT
ASTER

Boutique

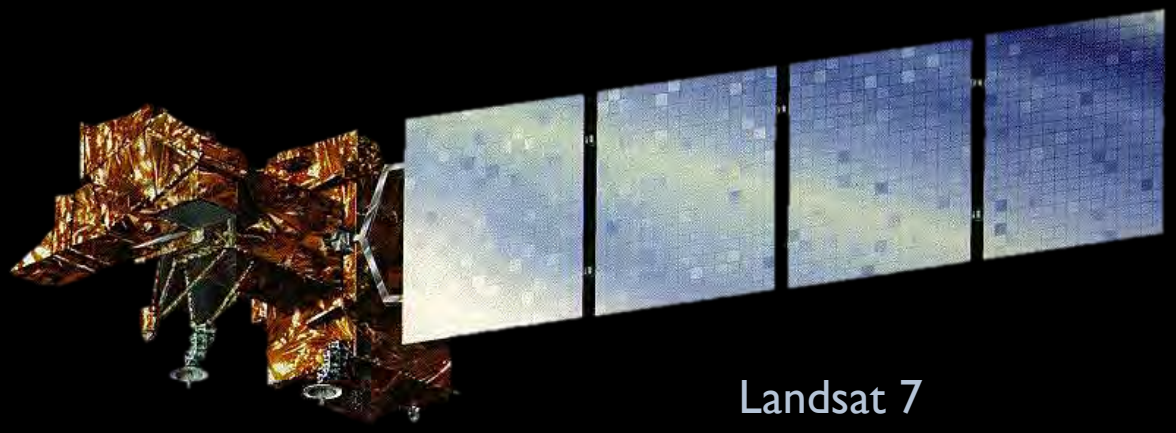
Gravity
Altimetry
Passive Microwave

High Resolution Optical

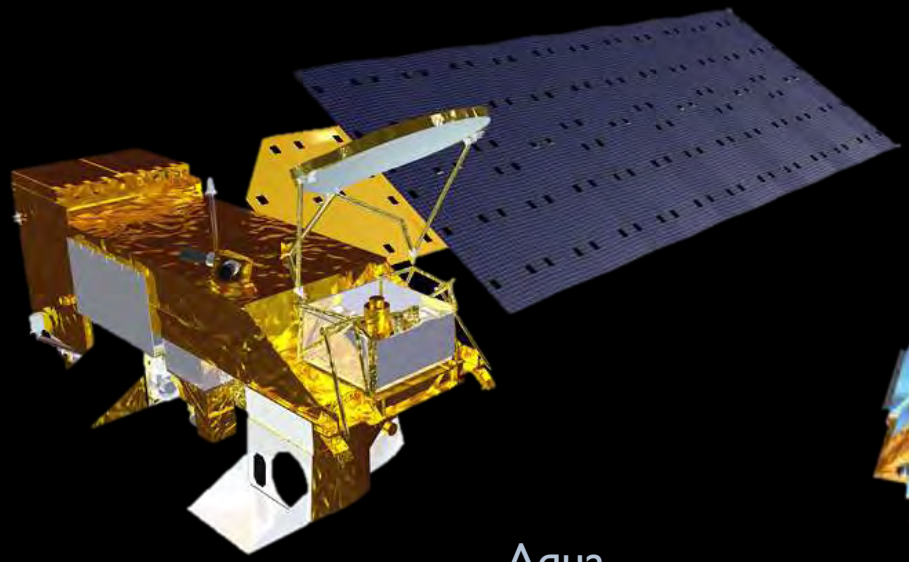
Worldview-1,2,3
Geoeye
SPOT

NASA's Optical Satellites

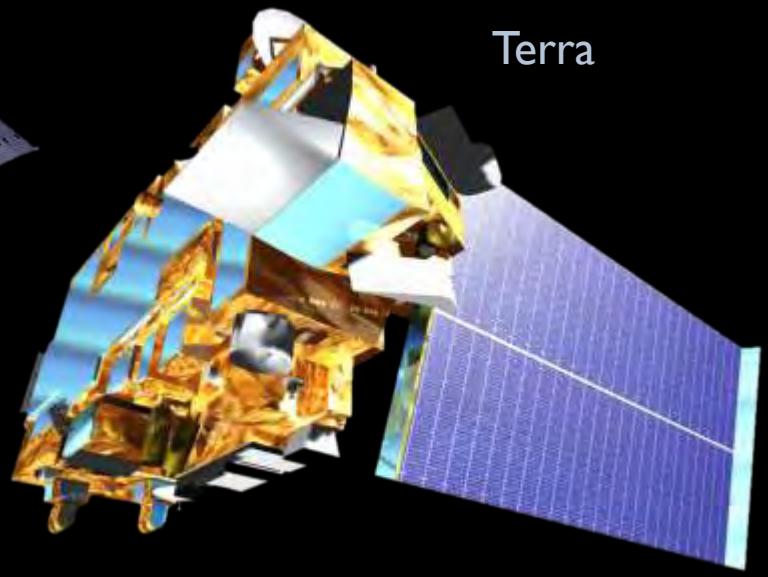
Landsat 8



Landsat 7



Aqua

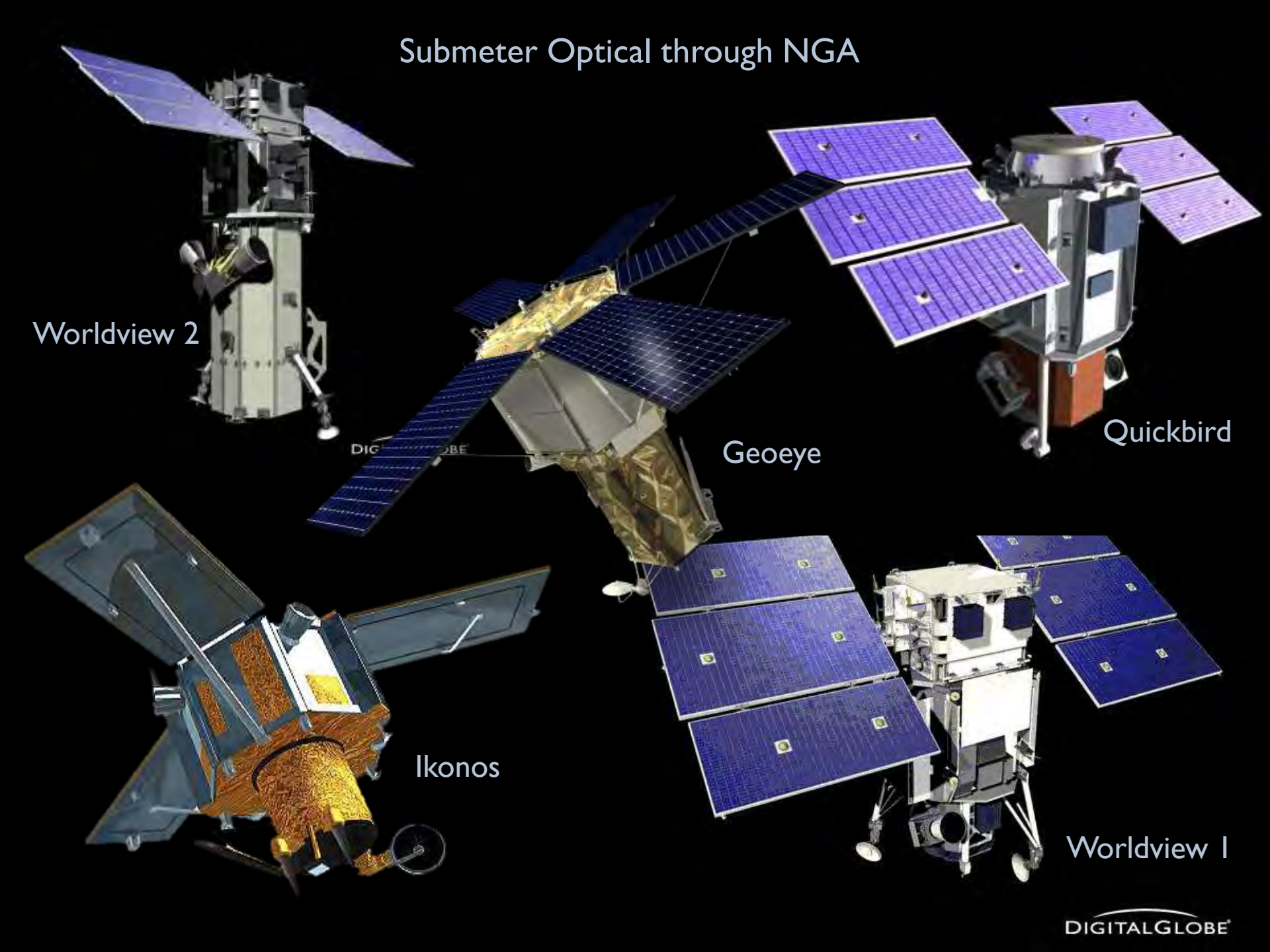


Terra

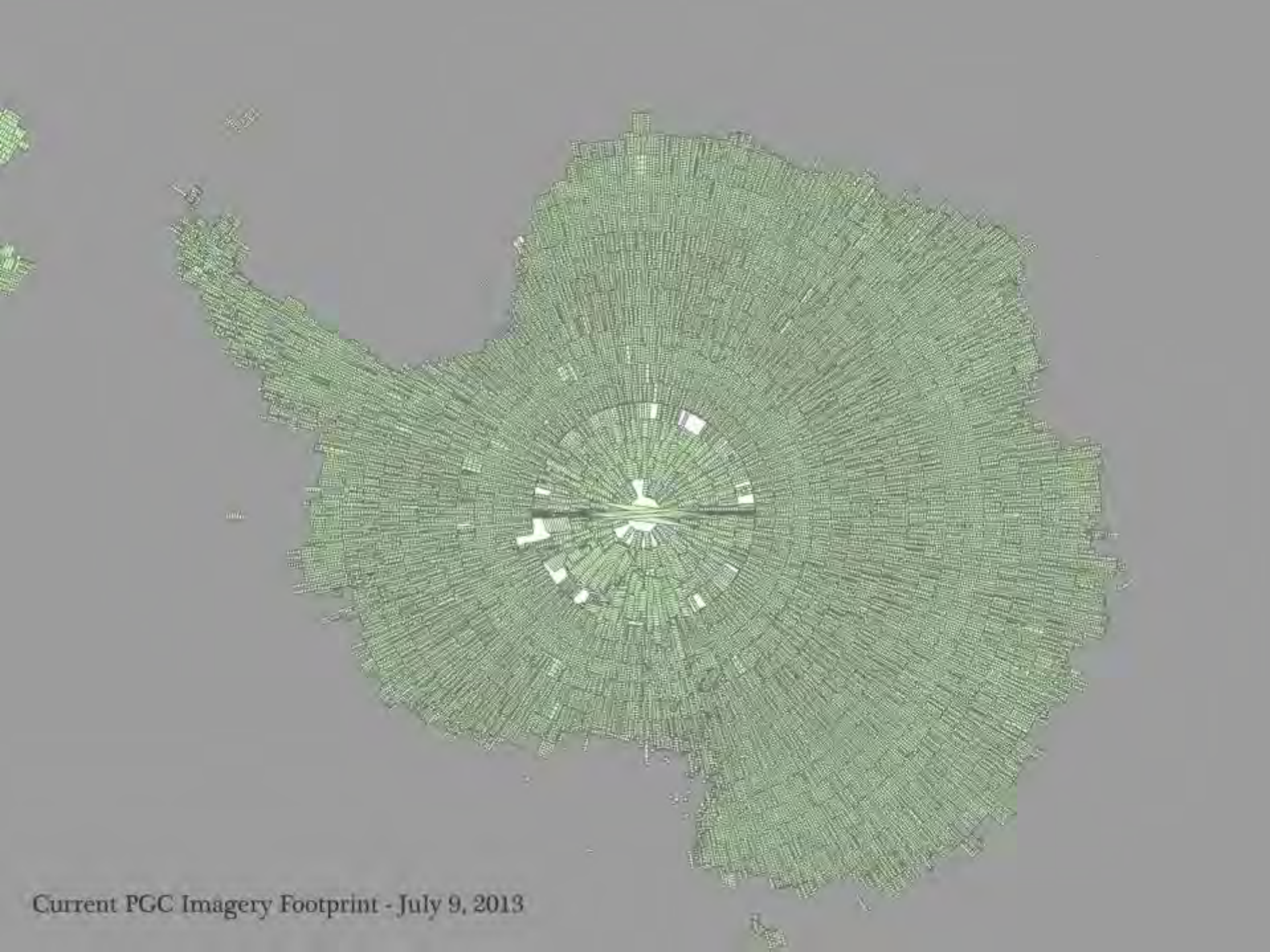
MODIS

23 Aug 2013

Submeter Optical through NGA



DIGITALGLOBE



Current PGC Imagery Footprint - July 9, 2013

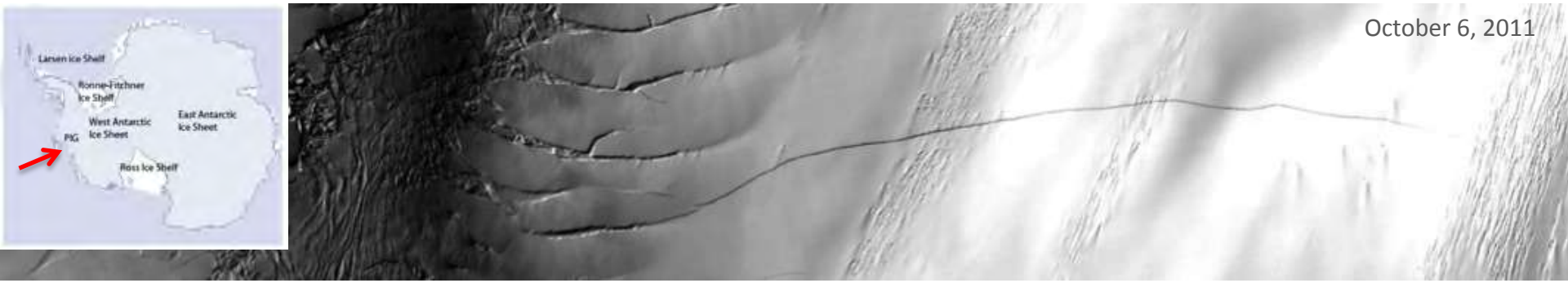
PGC camp in Bull Pass
QuickBird-2 (January 2009)

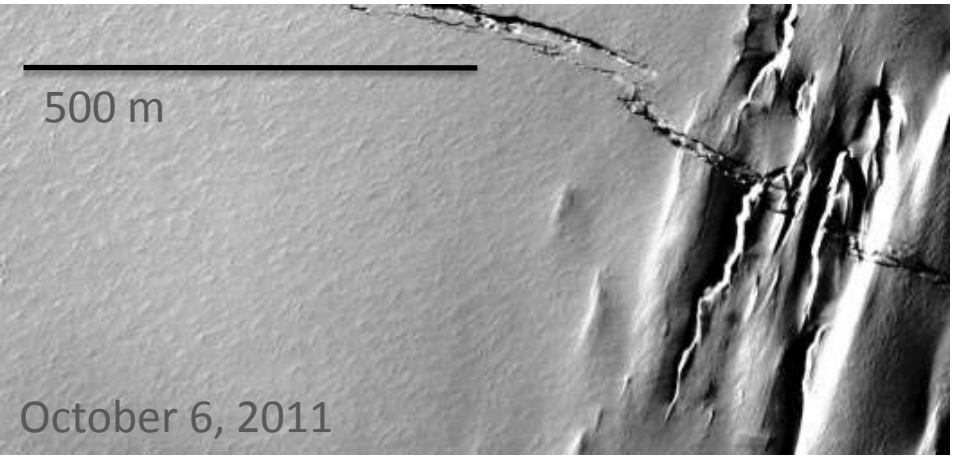
Atka Bay Colony

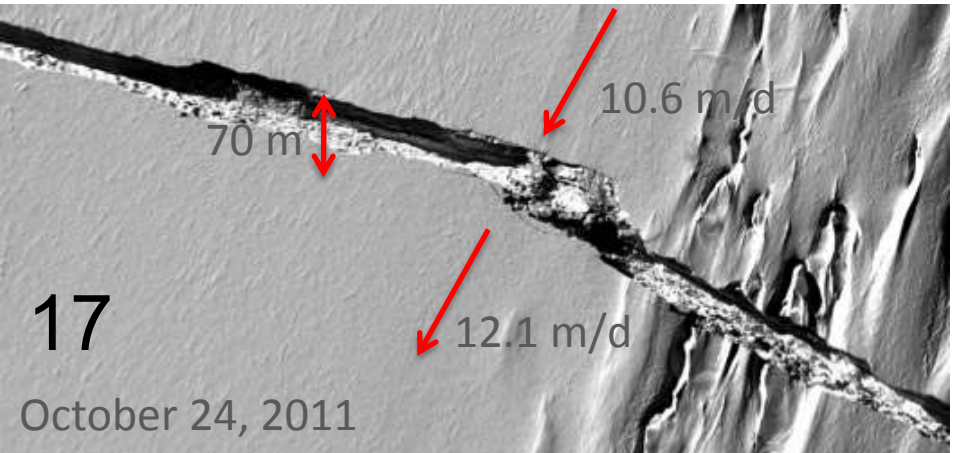
near Neumeyer Station

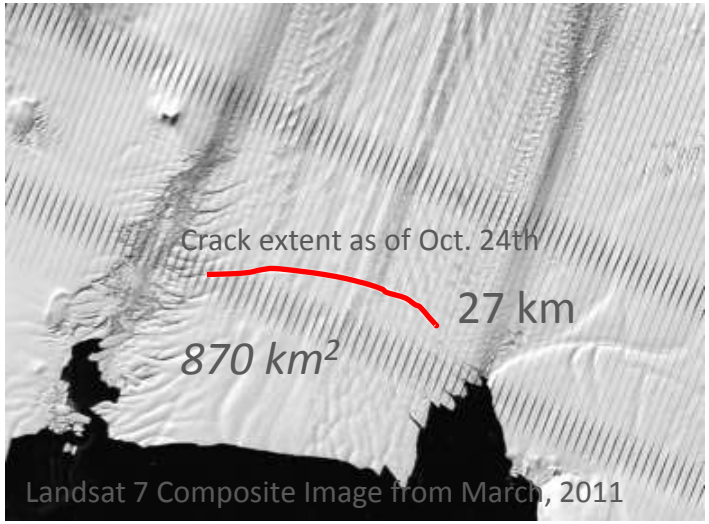
September 2, 2012

Pine Island Glacier Rifting



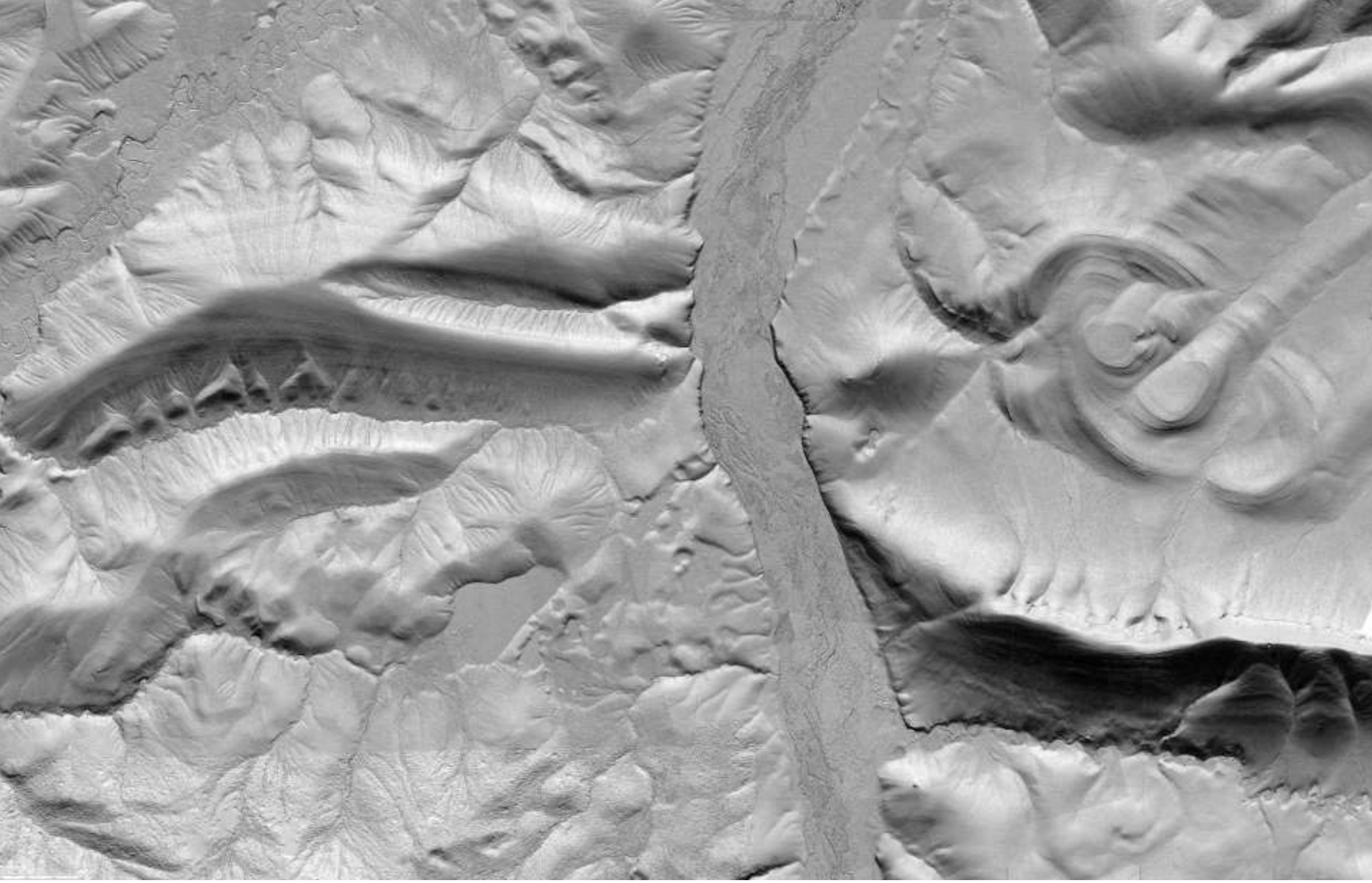






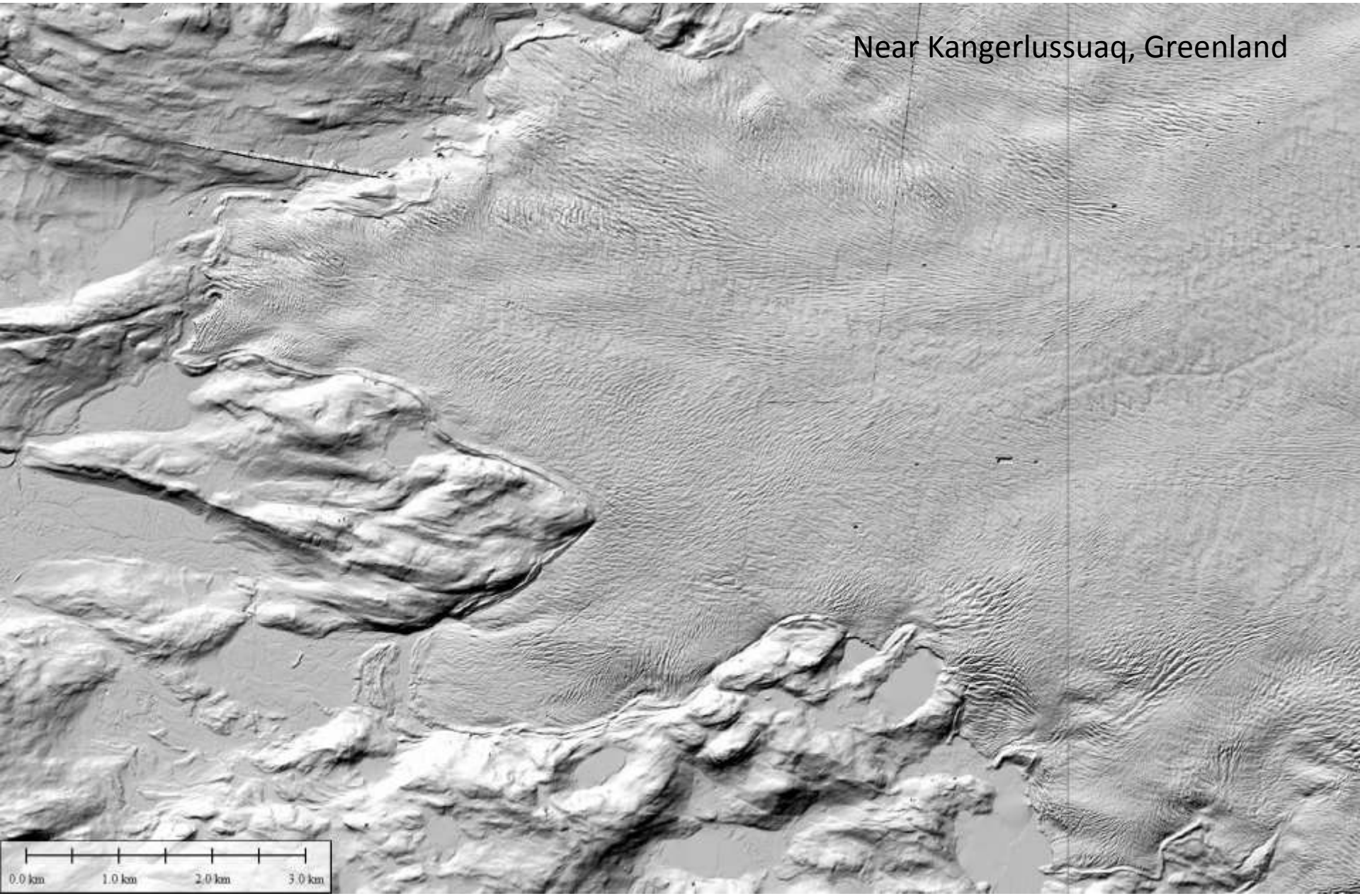
- Opened sometime between 9/25 and 10/6
- Ice down-glacier of the crack flowing ~2 m/day faster than up-glacier.
- Crack in nearly same location as event in 2001

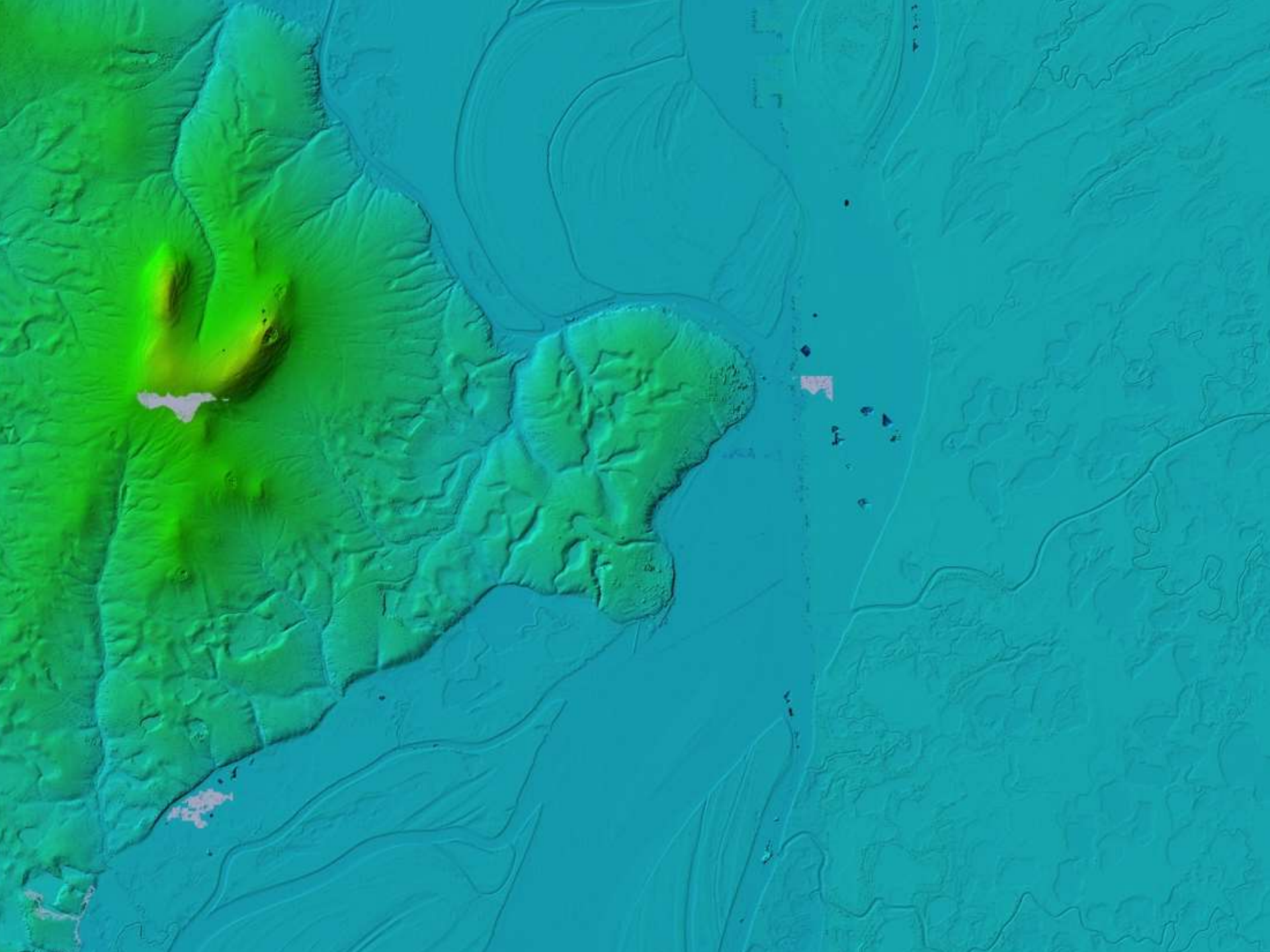
A high data volume day at PGC. This shipment was about 10 tb or 20-30,000 scenes.



Shaded relief image of a 4m posting elevation model near the Toolik LTER on the north slope of Alaska. Over 60% of Alaska has been shot in stereo.


Barrow, Alaska

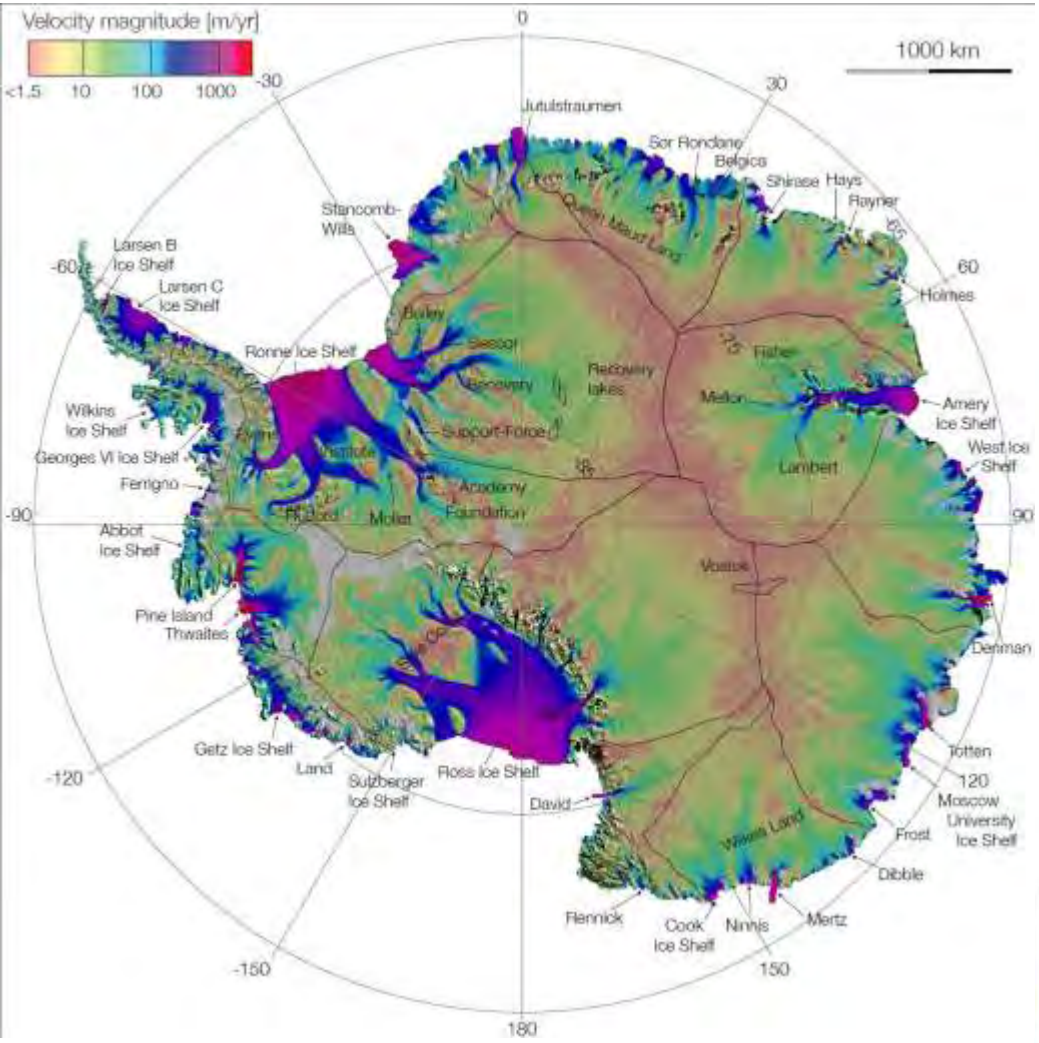

Near Kangerlussuaq, Greenland
0.0 km
1.0 km
2.0 km
3.0 km

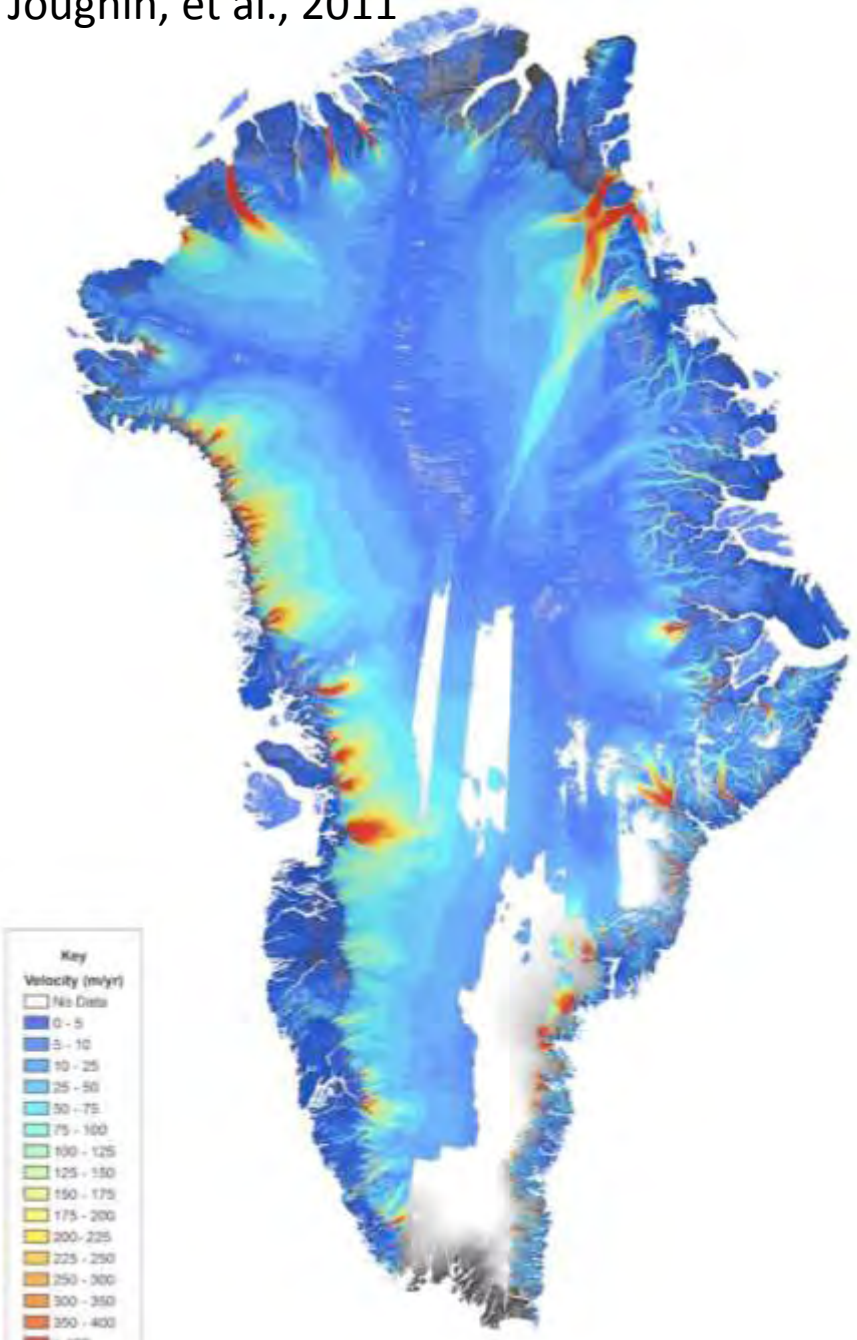



DigitalGlobe
Stereo Footprint
August 12, 2013
pgc
NSF

Commercial RADAR

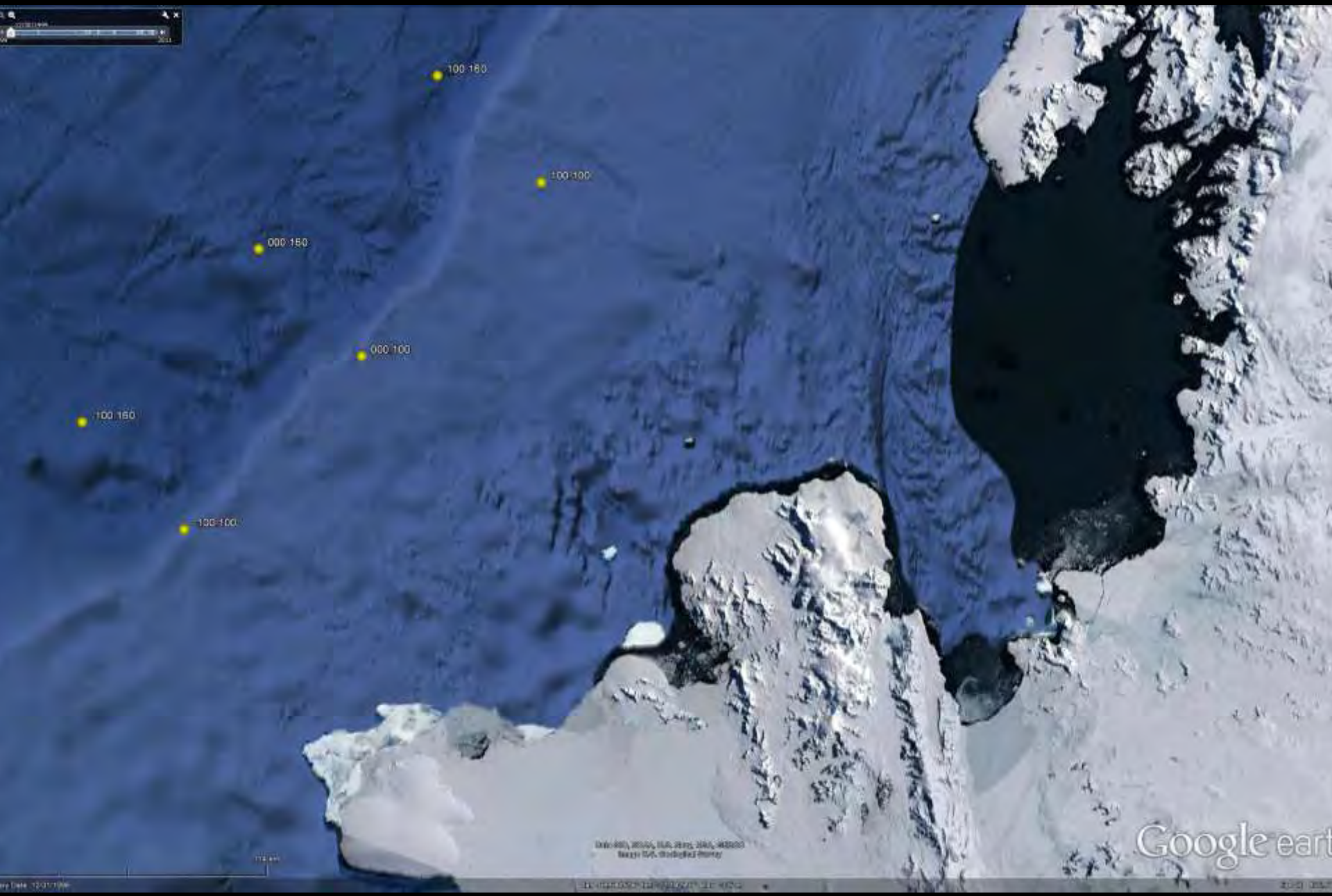
Joughin, et al., 2011



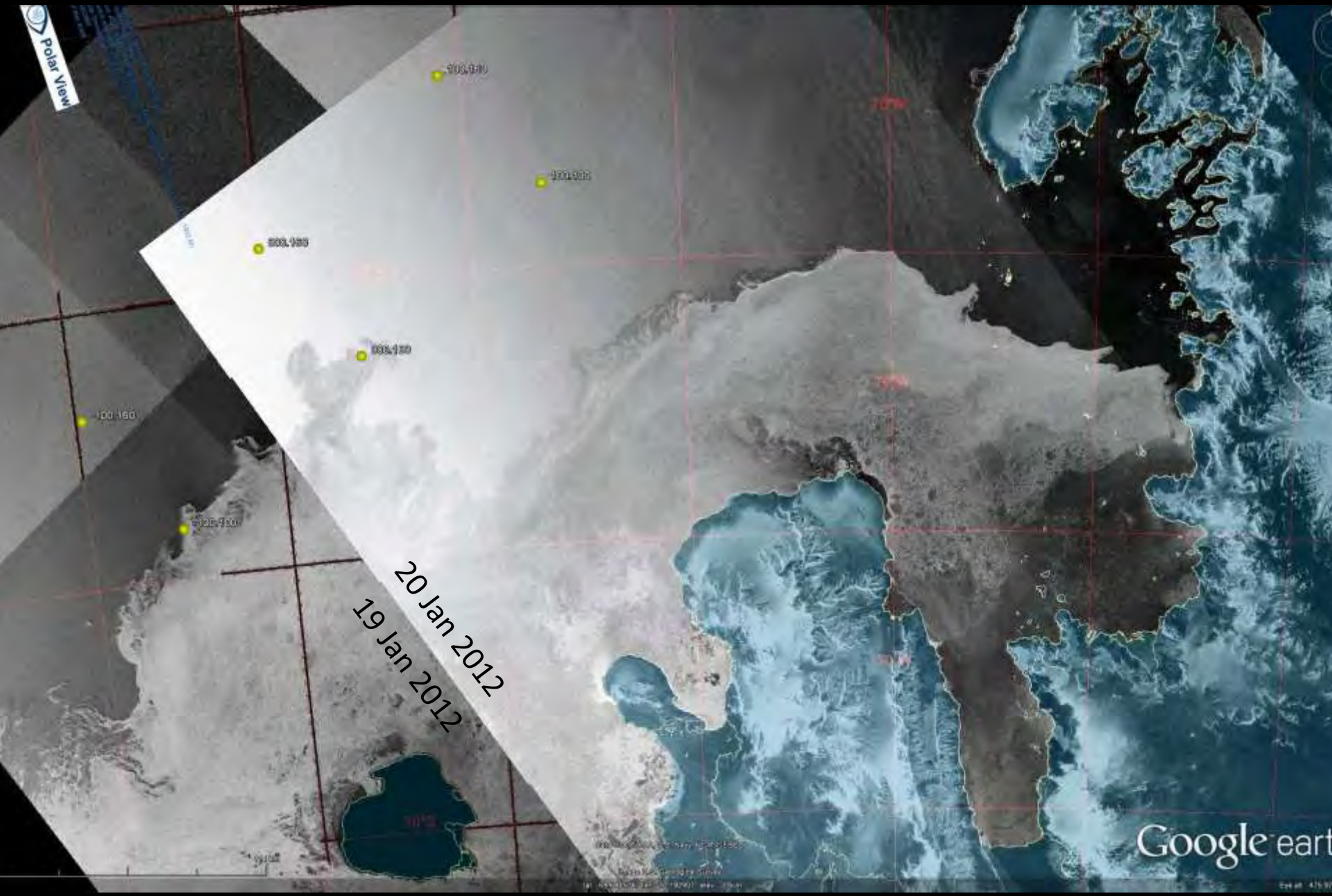


Rignot, et al., 2011

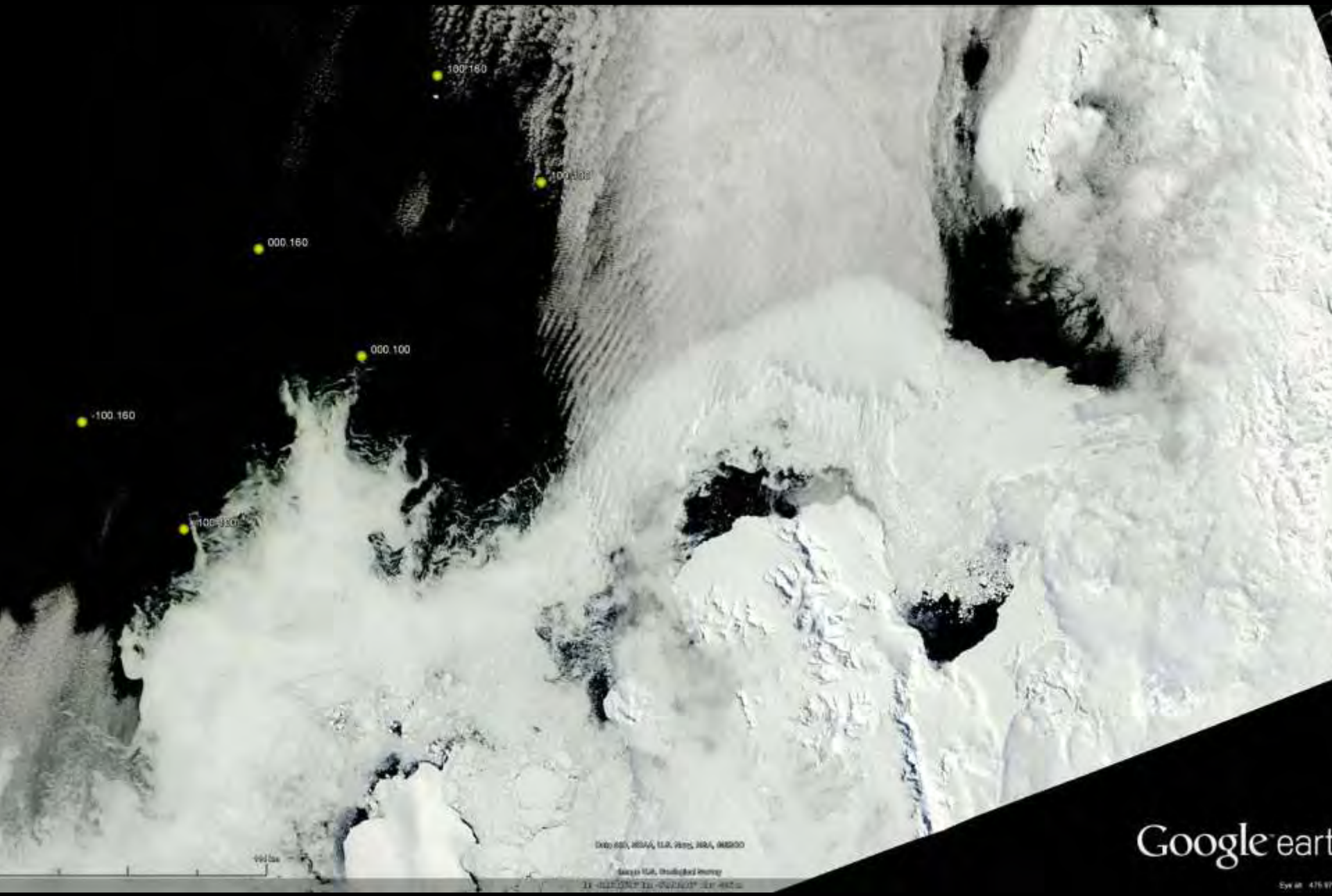
Envisat



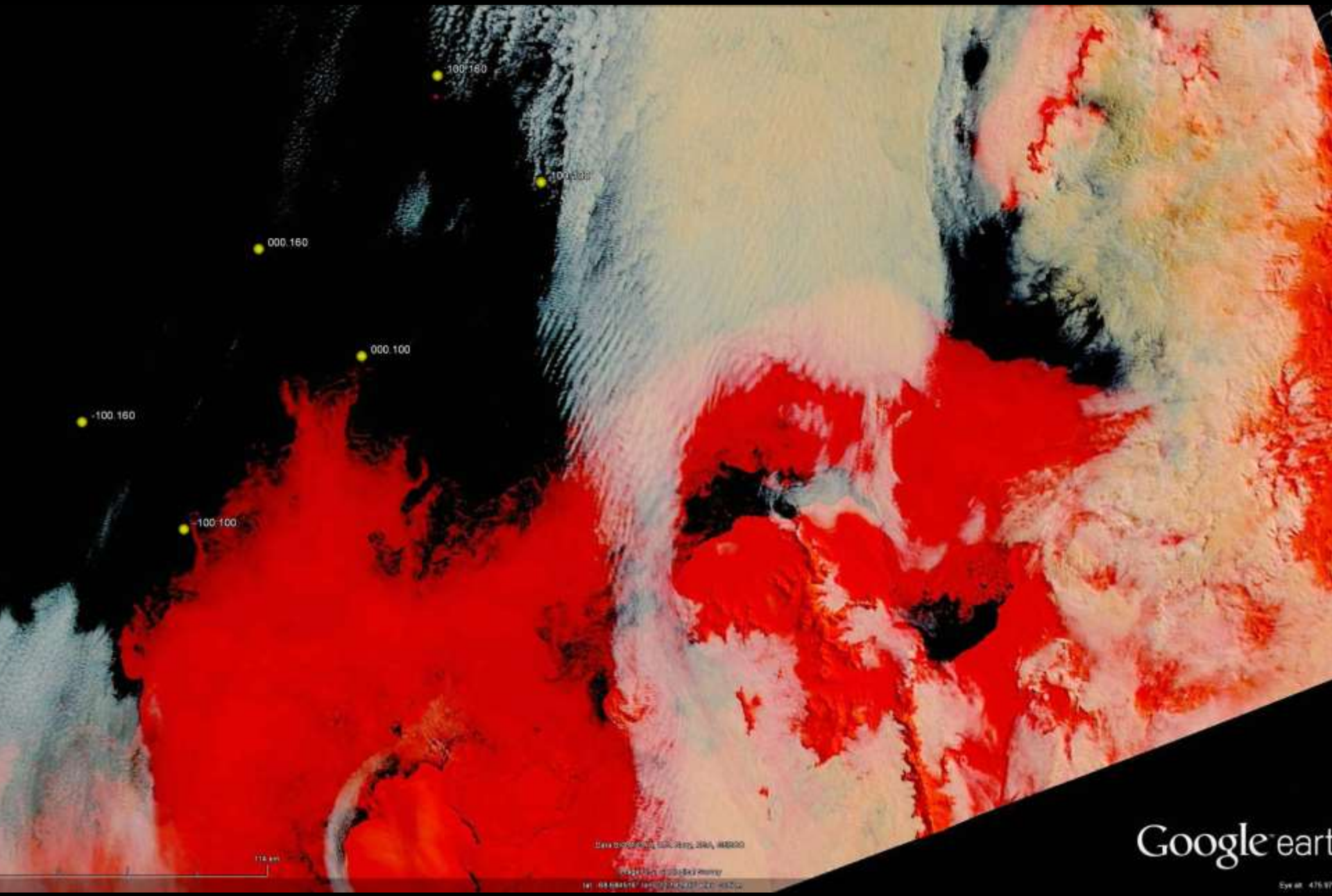
Google Earth Basemap with LTER Locations



ENVISAT RADAR Composite



MODIS True Color 19 Jan 2012



MODIS Bands 361 19 Jan 2012

Jan 23 Radar Image with LTER -100 line stations (approx)

Alexander Island

-100.000

-100.040

Charcot Island

-100.100

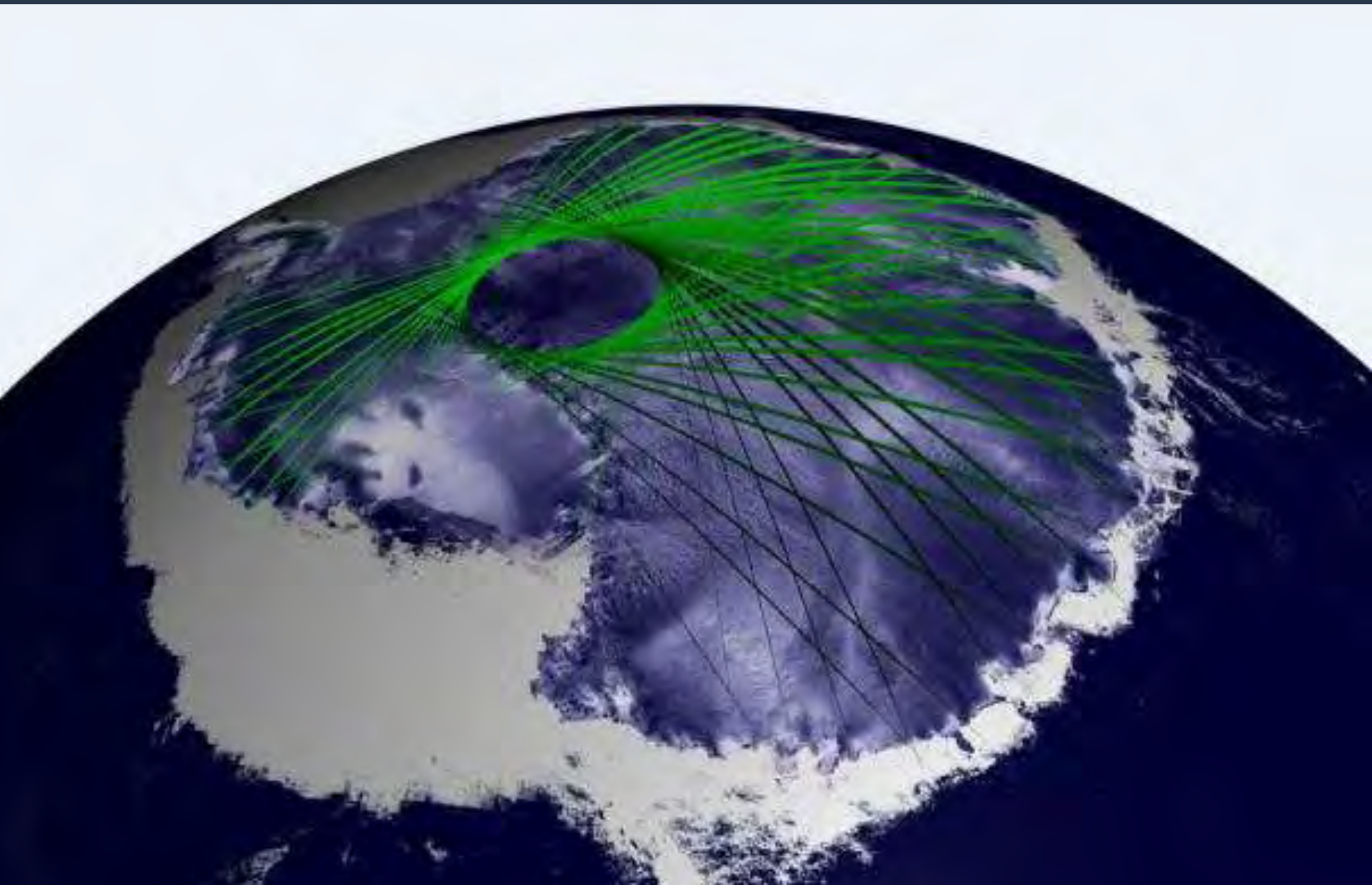
Scientific Holy Grails

- Topography
  - Sea ice freeboard
  - Ice surface
  - Thermokarst collapse
  - Snow accumulation
- Time series
- Imagery that can see through clouds and in the winter
- Access to more commercial data
- Data digestible by non-geospatial users

CI Specific Grails for GIS and Remote Sensing

- Web services
- Data in formats easily digestible by end users
- Big, cheap, slow storage
- Data fusion tools for data that crosses communities

The benefit of a polar orbit



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What is unique about polar remote sensing?

- VERY frequent coverage for polar orbiting satellites
- Little competition for satellites that can be tasked
- Ground truth is hard to come by
- Importance of licensed imagery
- Importance of satellite RADAR
- Incredible data flow

www.pgc.umn.edu

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