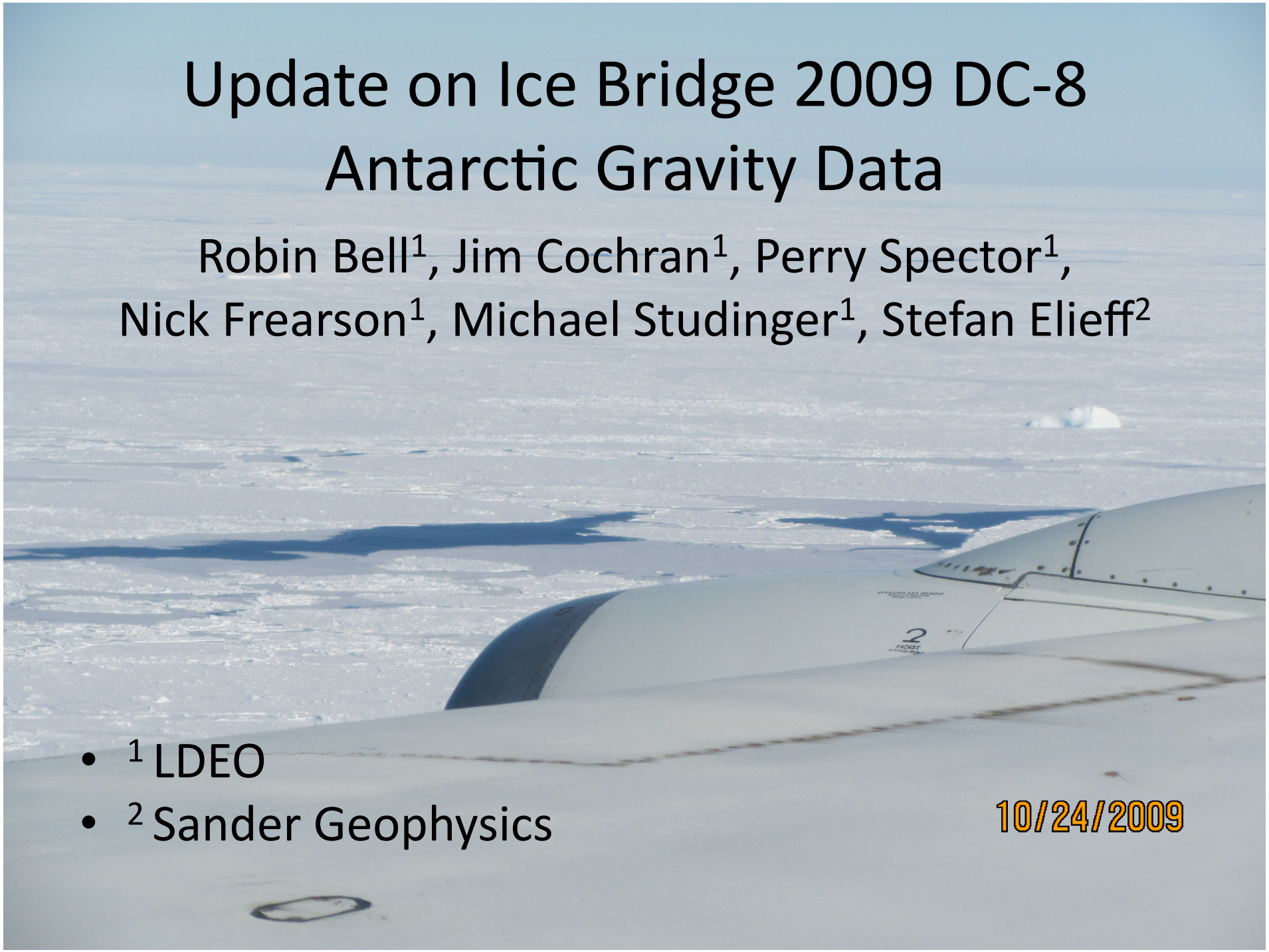
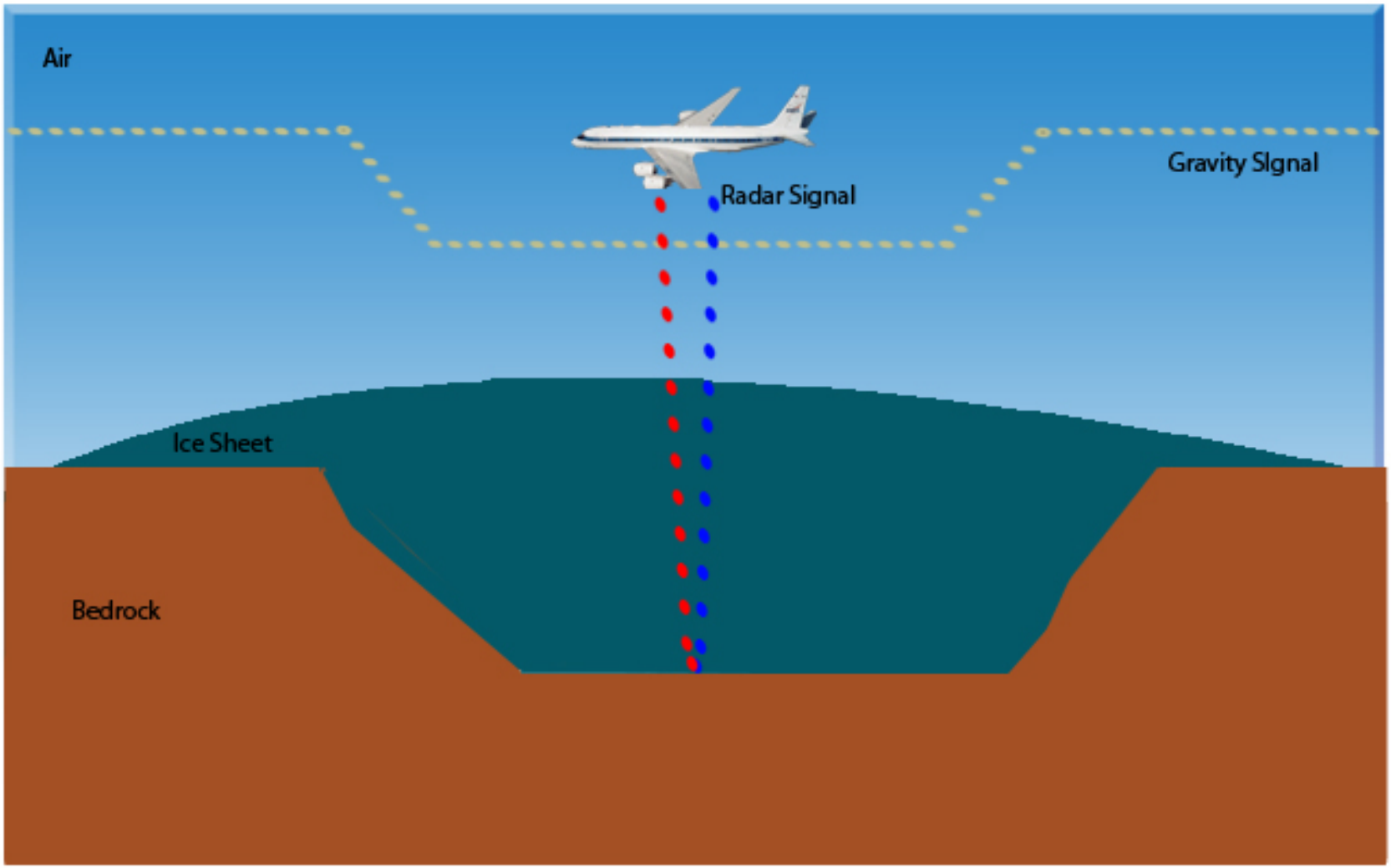
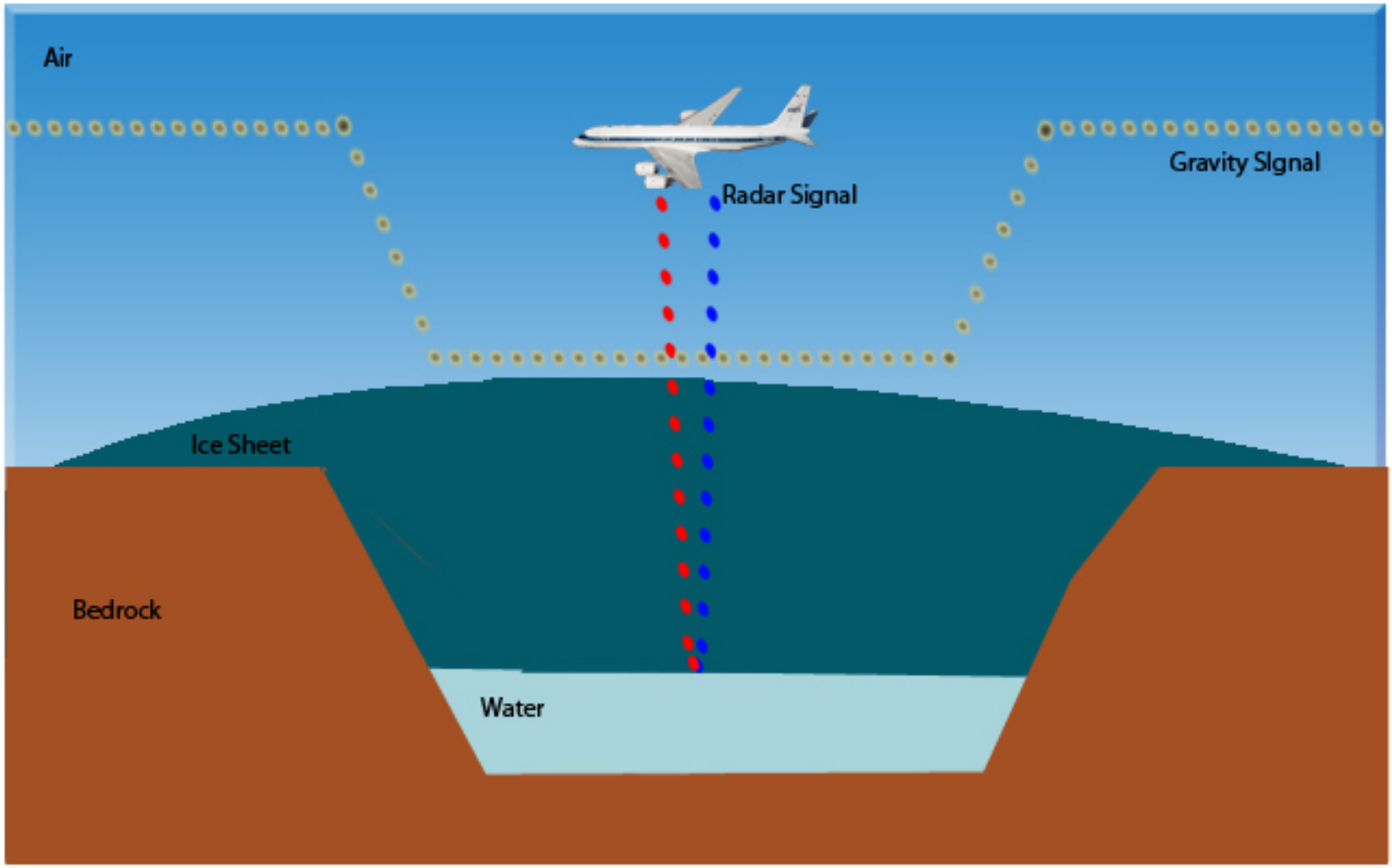
Update on Ice Bridge 2009 DC-8 Antarctic Gravity Data

Robin Bell[1], Jim Cochran[1], Perry Spector[1], Nick Frearson[1], Michael Studinger[1], Stefan Elieff[2]

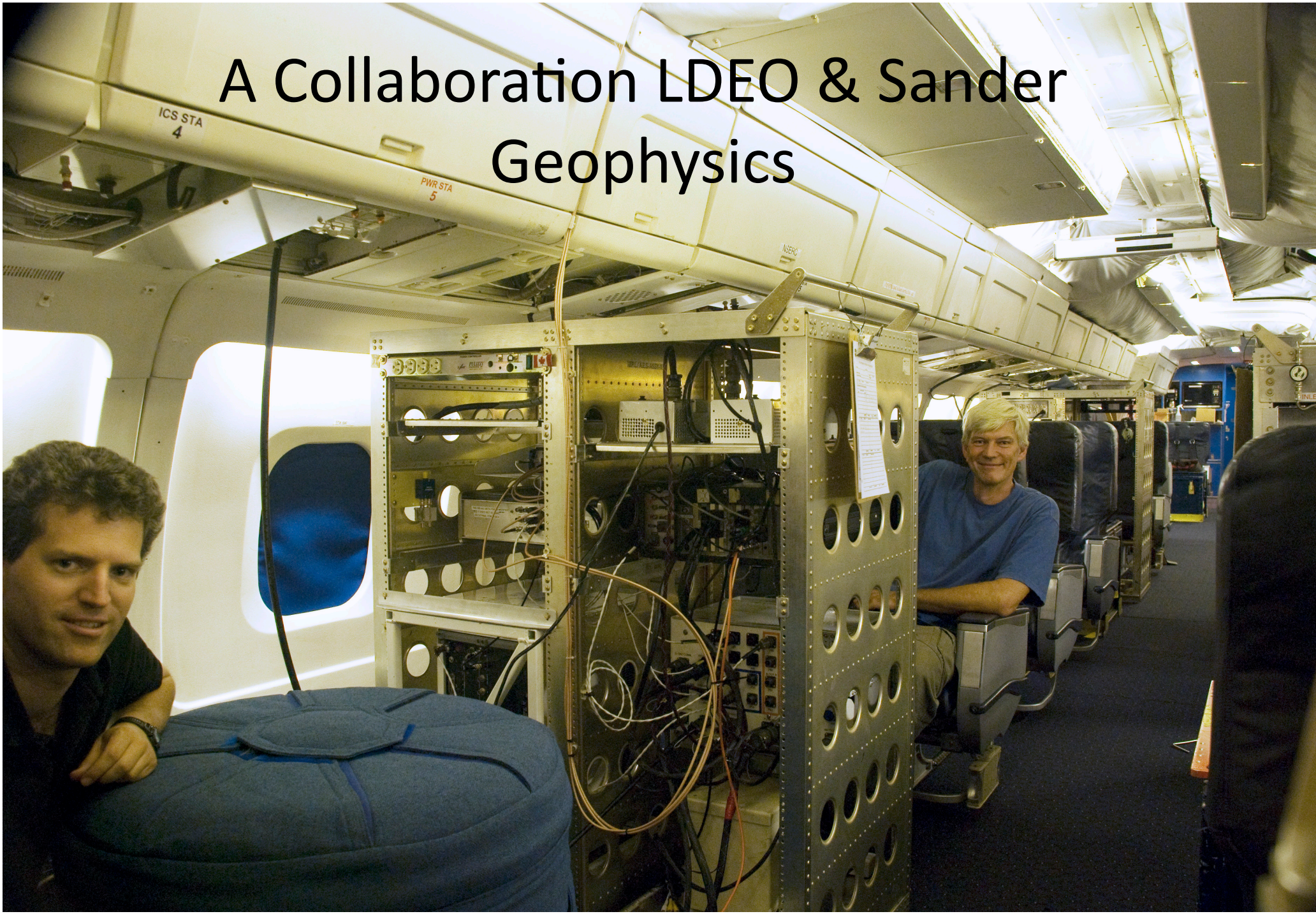


- [1] LDEO
- [2] Sander Geophysics


Air
Gravity Slgnal
Radar Signal
Ice Sheet
Bedrock


Air
Gravity SIgnal
Radar Signal
Ice Sheet
Bedrock
Water

A Collaboration LDEO & Sander Geophysics



Collaboration
LDEO and Sander

- 2007 Dedicated Gravity Evaluation Program High Arctic (Twin Otter)
- 2008 Greenland Integration and Testing Full Geophysical Equipment Suite (Twin Otter)
- 2008-9 East Antarctica Gamburtsev Mountain Expedition-IPY AGAP Project (Twin Otter)
- 2009 Ice Bridge Antarctic Mission (DC-8)

Strength of Air GRAV System

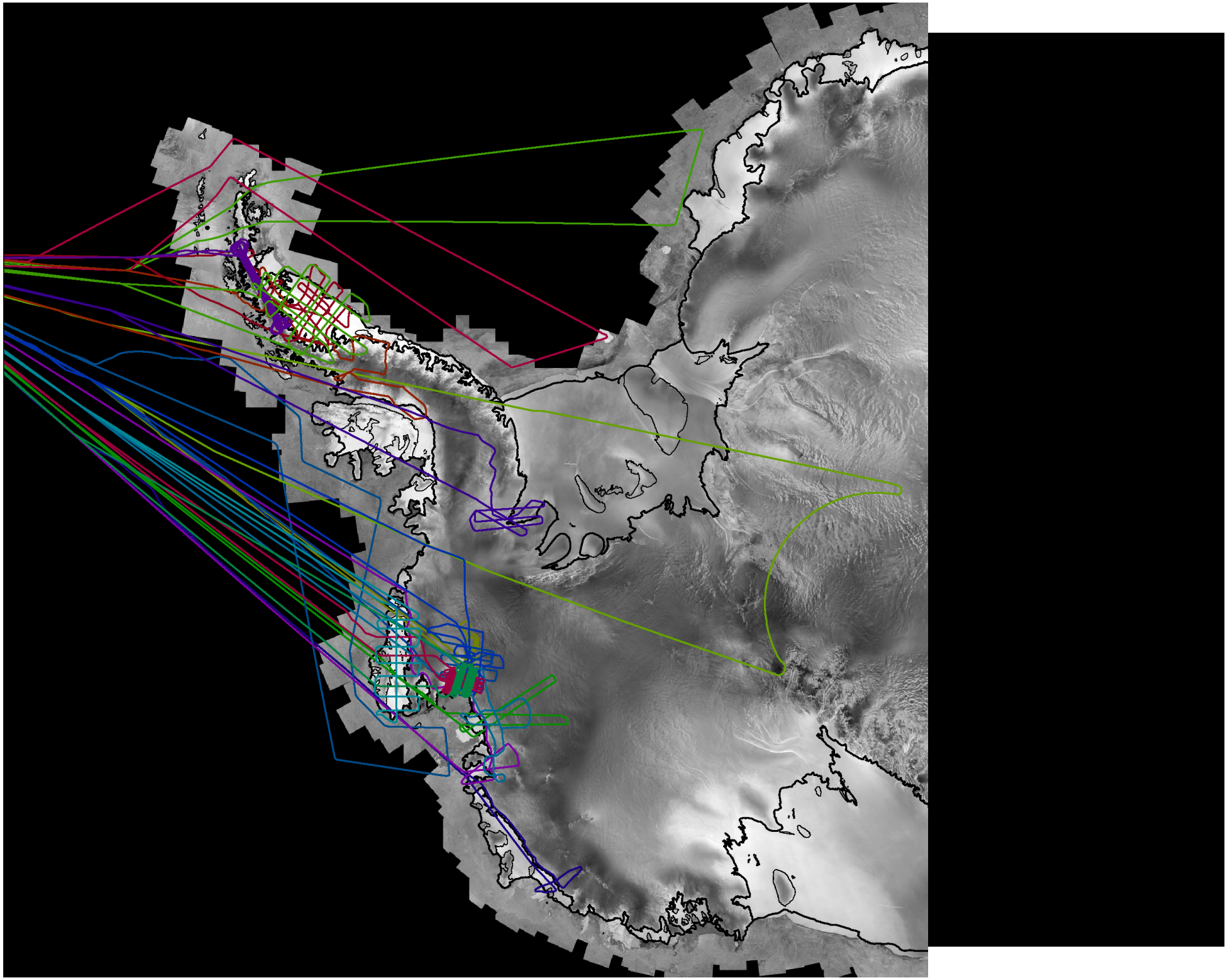
- Capable Recovery Data During Draped Flight
- High Resolution Gravity Field

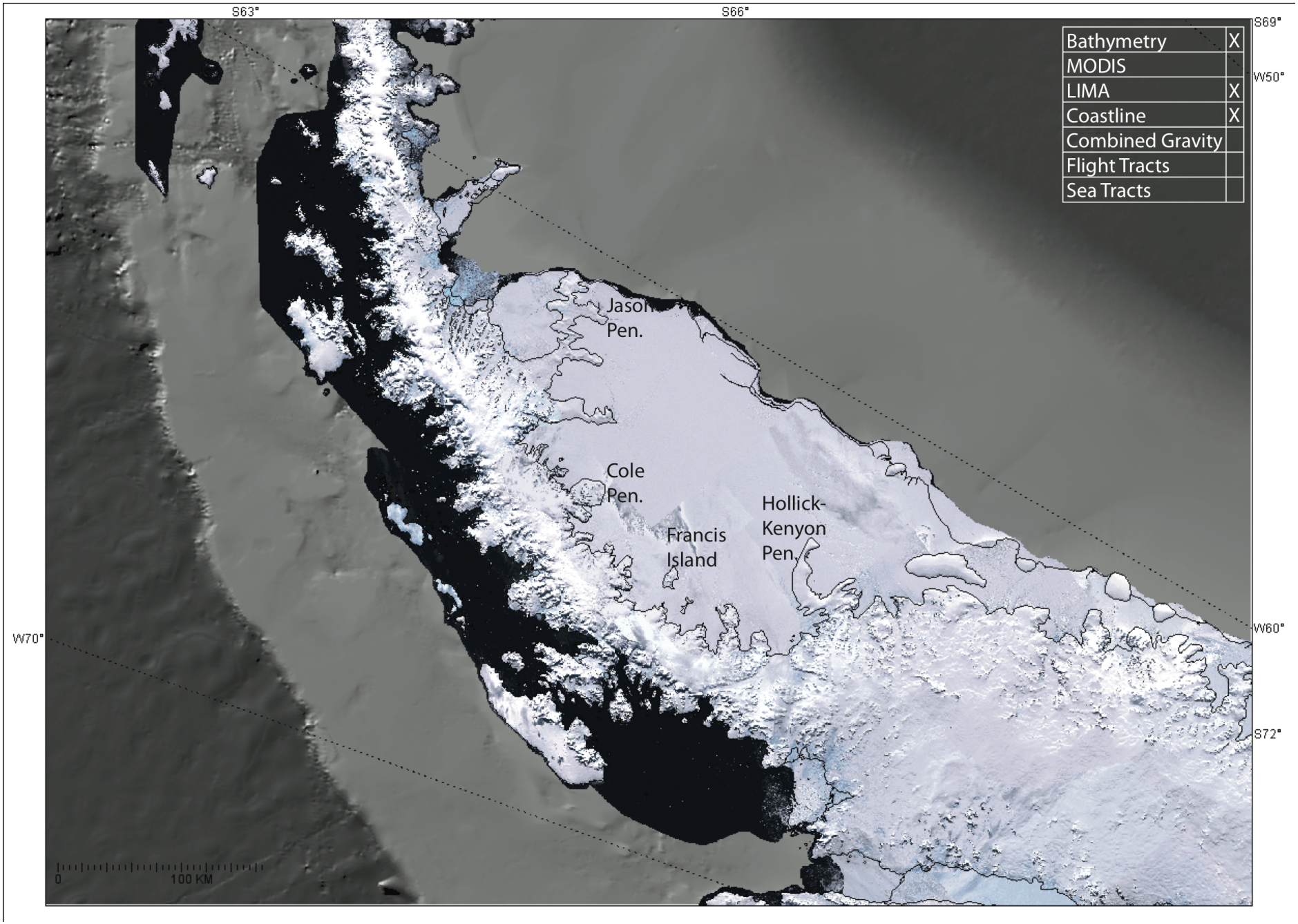
- Limitation and Resolution Costs
  - Flying Fast (DC-8 (~7.5km) vs Twin Otter (2-3km))
  - Flying High (i.e. LVIS vs ATM) $1/r^2$ is real……

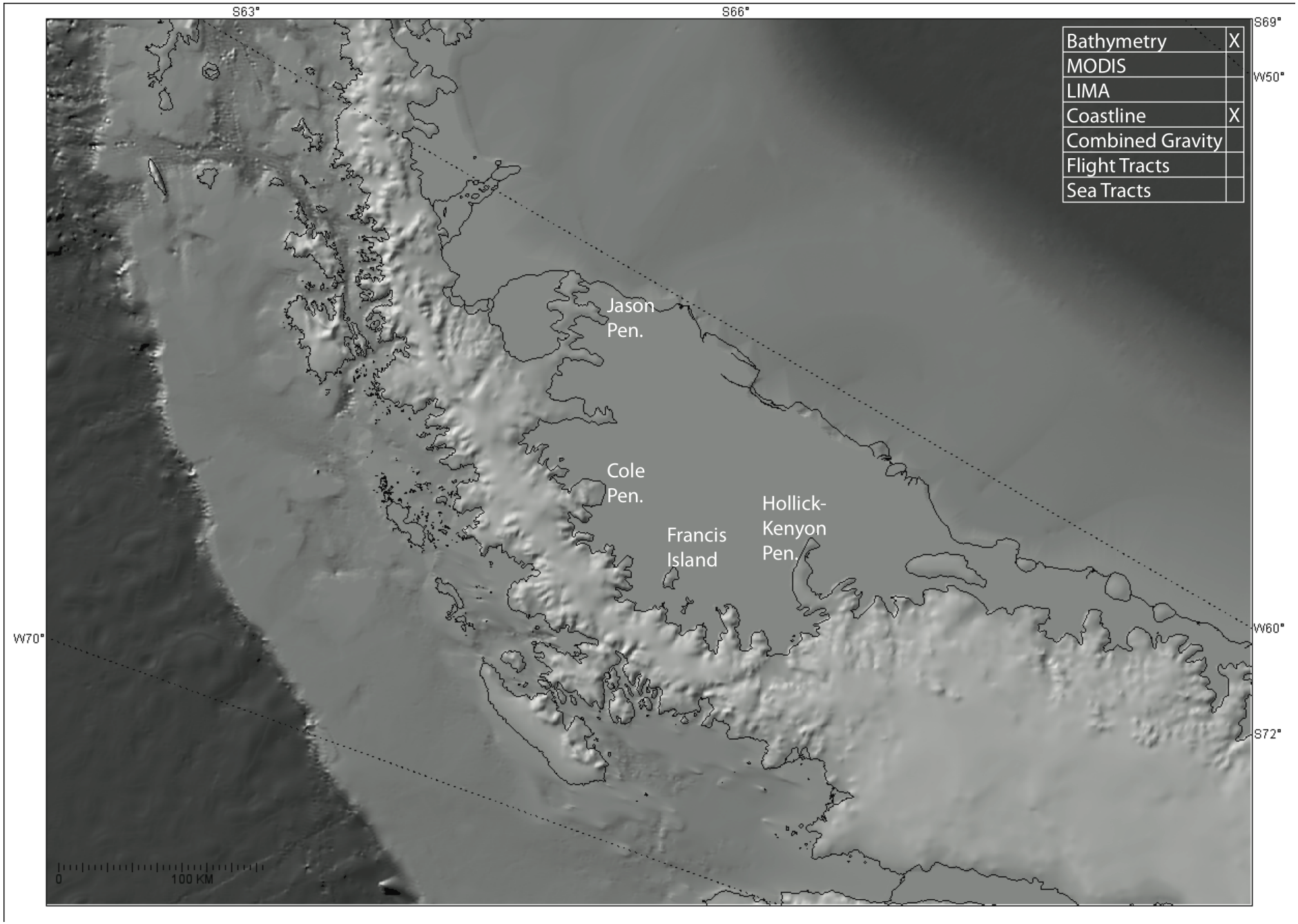
More to Come with Michaels FAQ's After Lunch

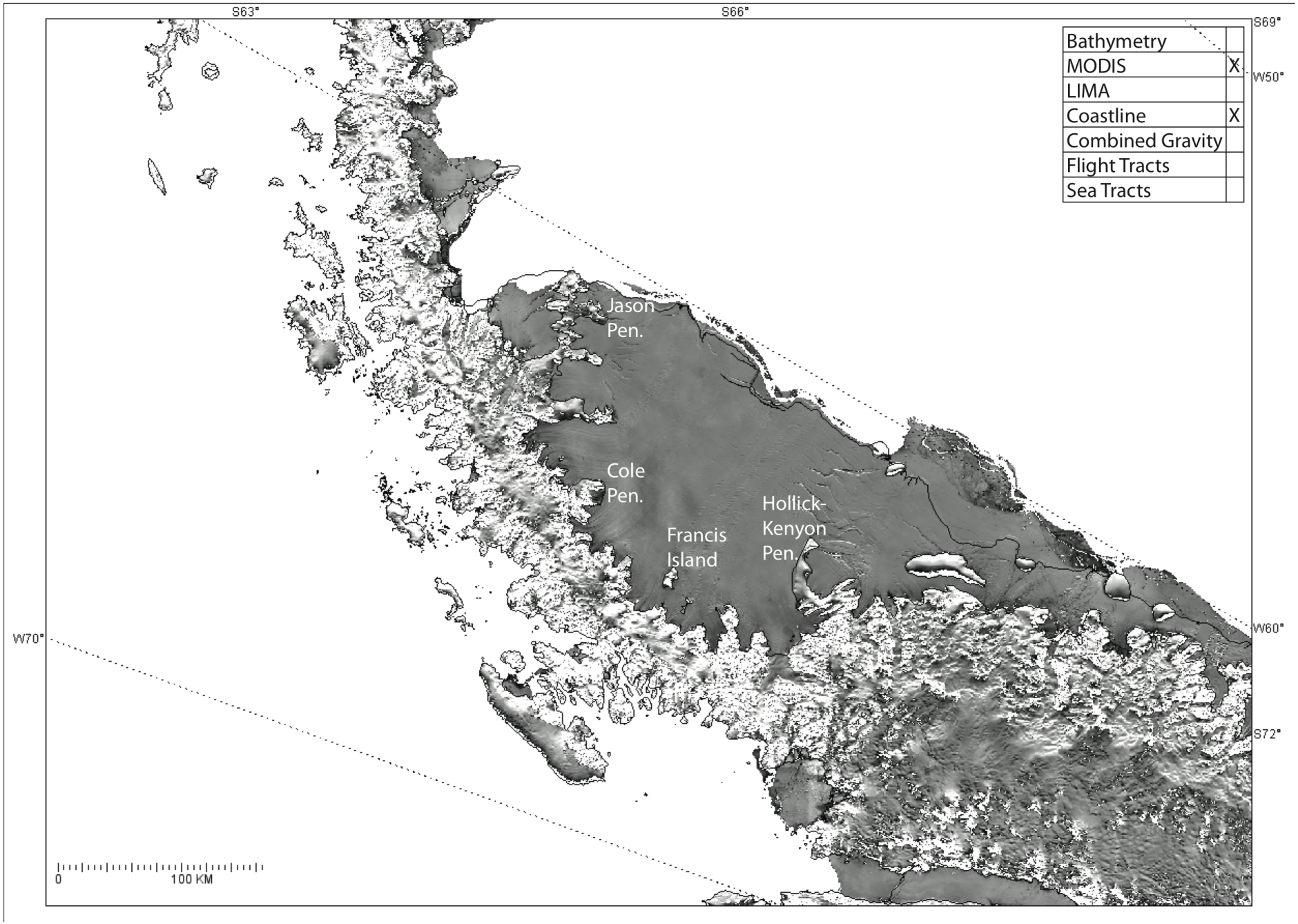
Data Acquired IceBridge Antarctica 2009

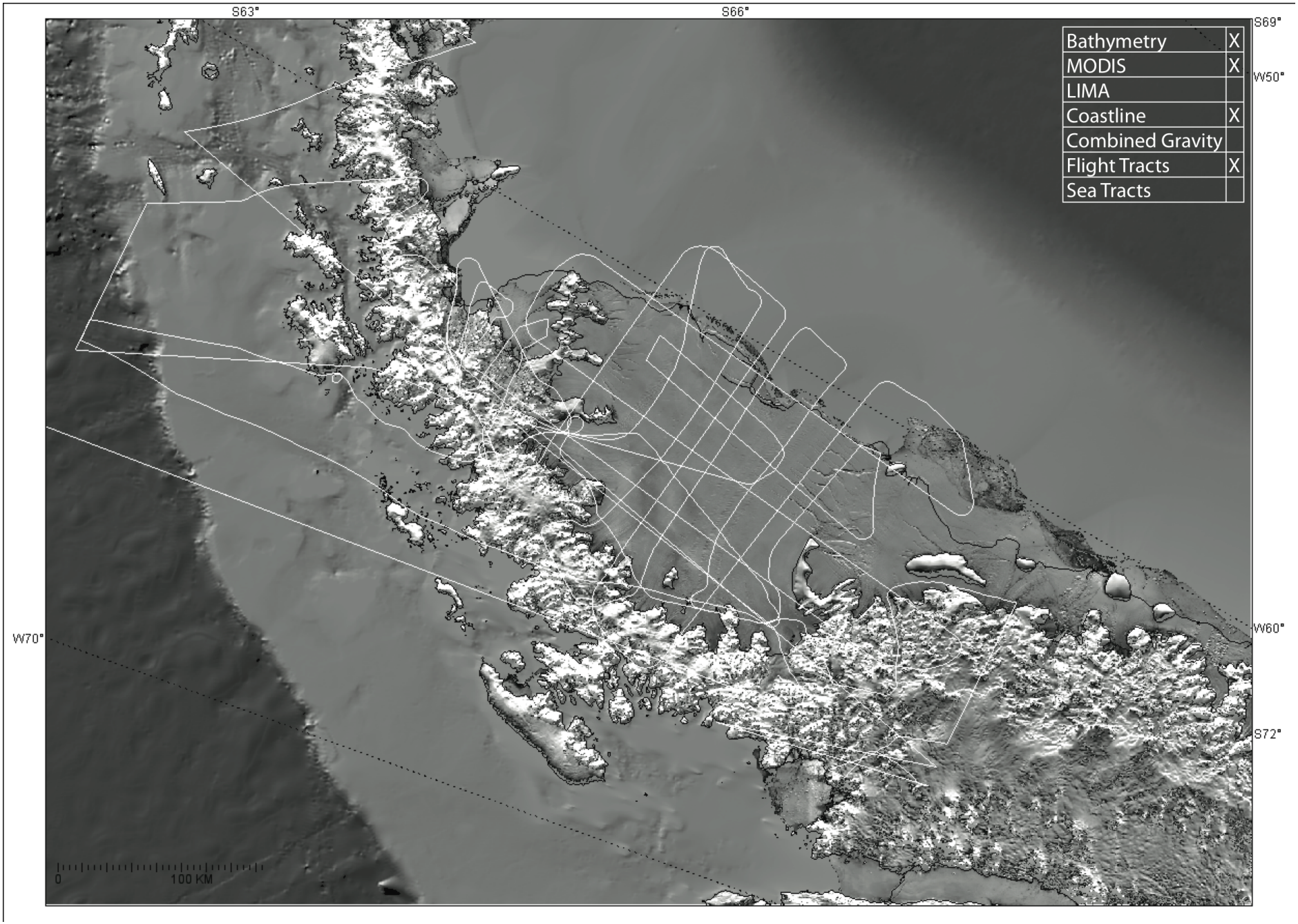
- Gravity data from 20 flights
- Acquisition Computer Failed 1 Flight (#13)
- Sander Working on Finalizing Free Air Gravity (Feb 2009)
- LDEO Developing Work Flow for Inversion for Bathymetry

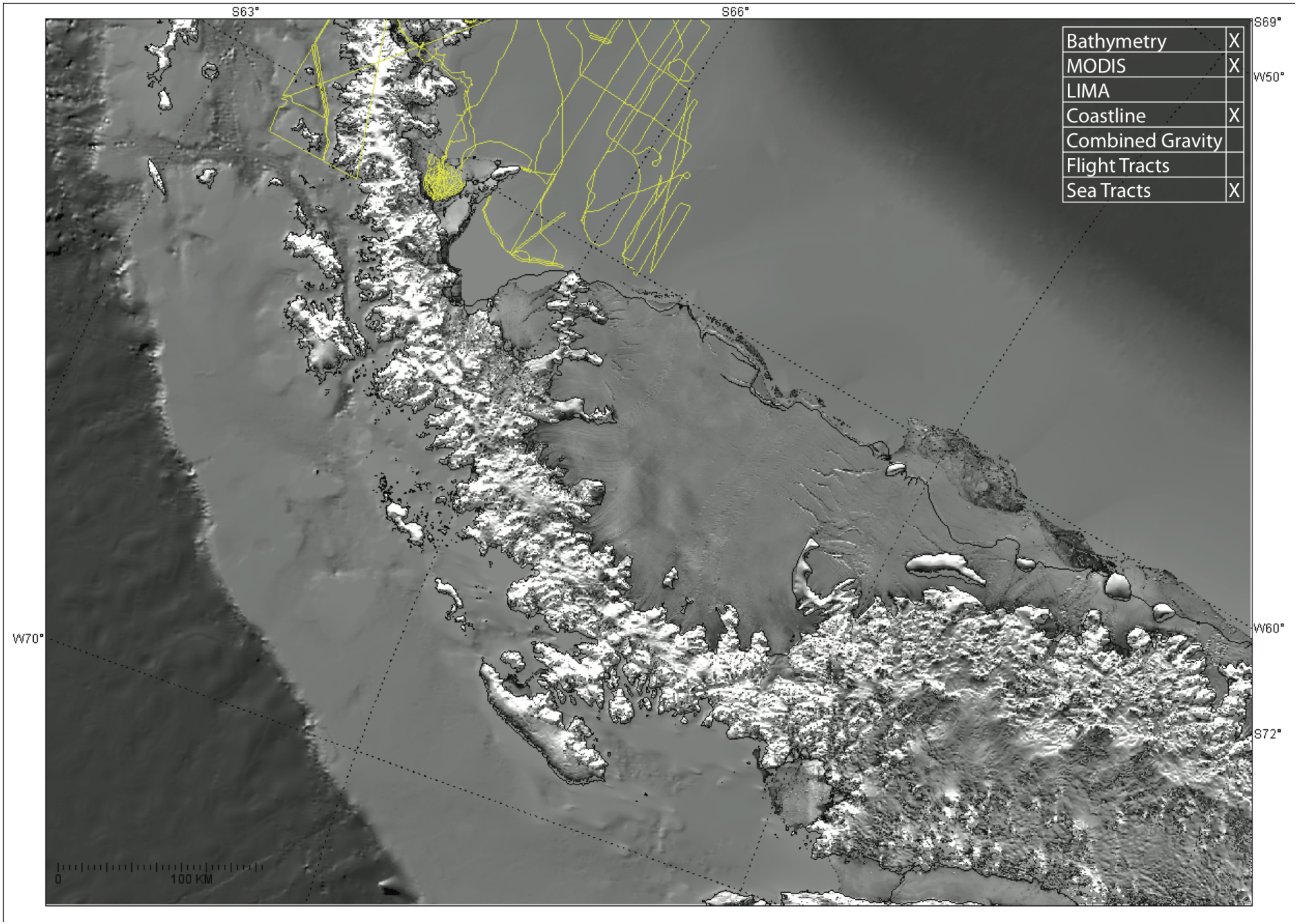


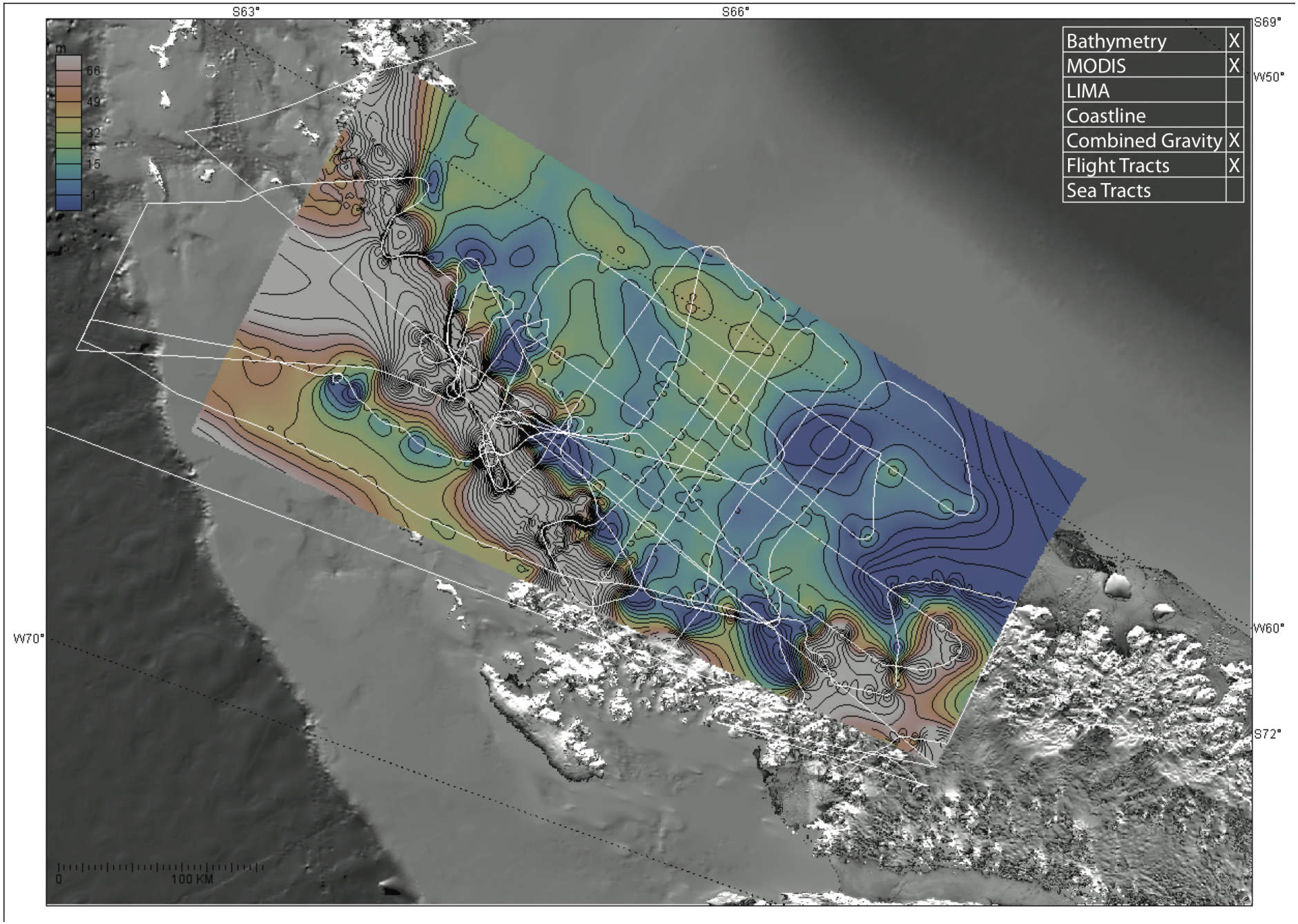

S63°
S66°
S69°
W50°
W60°
W70°
S72°
Bathymetry X
MODIS
LIMA X
Coastline X
Combined Gravity
Flight Tracts
Sea Tracts
Jason
Pen.
Cole
Pen.
Francis
Island
Hollick-
Kenyon
Pen.
0
100 KM

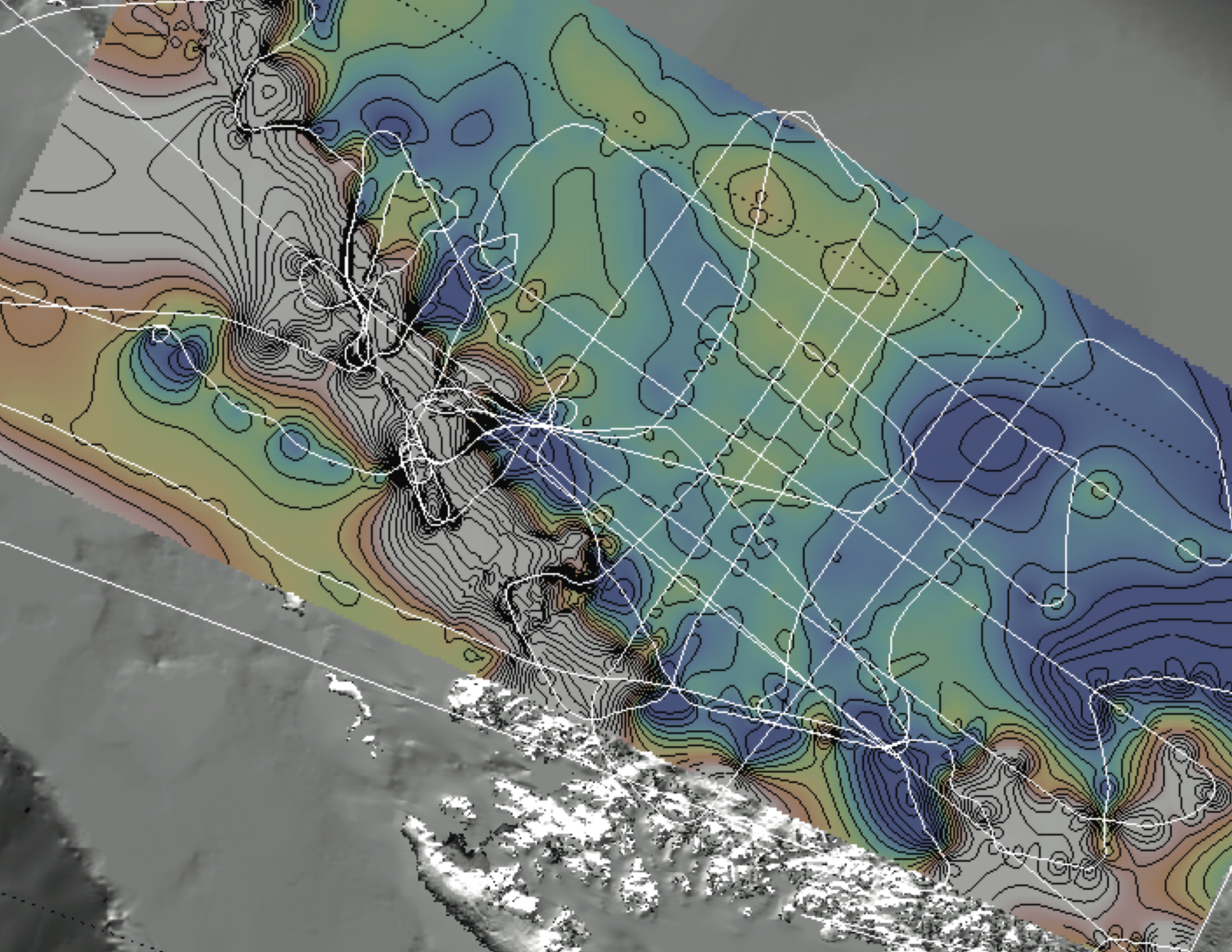

S63°
S66°
S69°
W50°
W60°
S72°
W70°
Bathymetry X
MODIS
LIMA
Coastline X
Combined Gravity
Flight Tracts
Sea Tracts
Jason Pen.
Cole Pen.
Francis Island
Hollick-Kenyon Pen.
0
100 KM

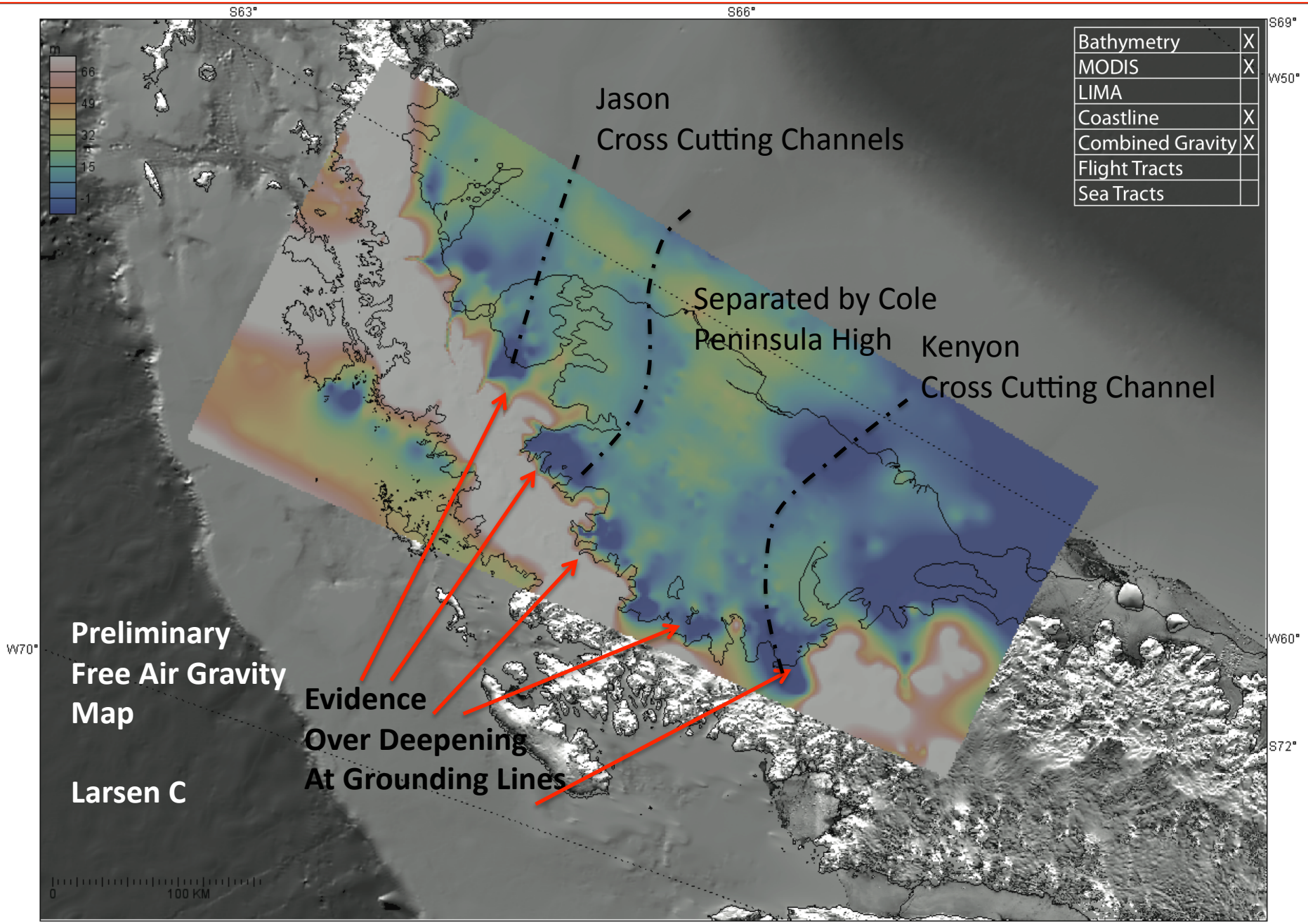

S63°
S66°
S69°
W50°
W60°
W70°
S72°
Bathymetry
MODIS X
LIMA
Coastline X
Combined Gravity
Flight Tracts
Sea Tracts
Jason Pen.
Cole Pen.
Francis Island
Hollick-Kenyon Pen.
0
100 KM

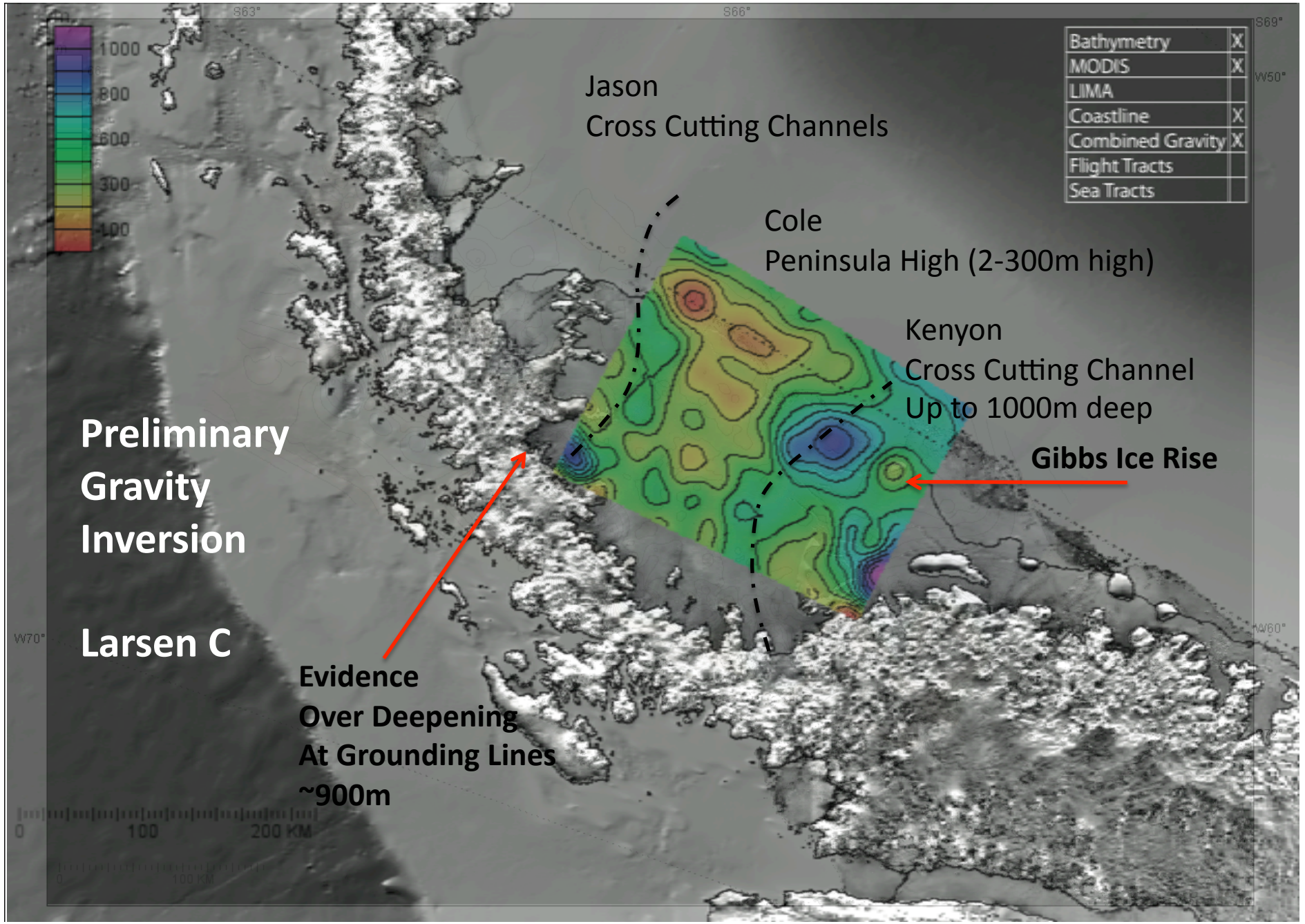

S63°
S66°
S69°
W50°
W60°
S72°
W70°
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity
Flight Tracts X
Sea Tracts
0
100 KM

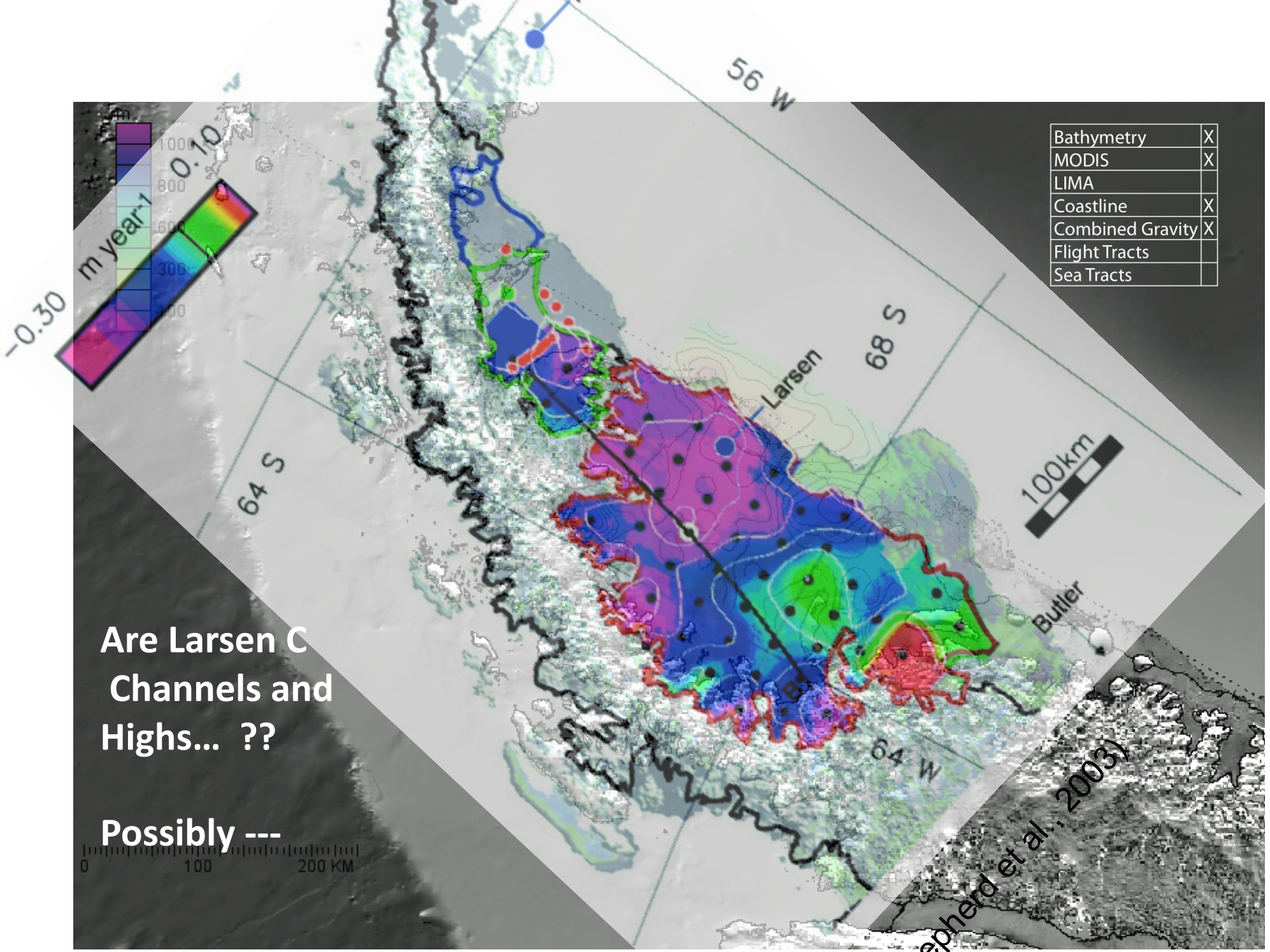

S63°
S66°
S69°
W50°
W70°
W60°
S72°
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity
Flight Tracts
Sea Tracts X
0
100 KM


S63°
S66°
S69°
W50°
W60°
S72°
W70°
m
66
49
32
15
-1
0
100 KM
Bathymetry X
MODIS X
LIMA
Coastline
Combined Gravity X
Flight Tracts X
Sea Tracts



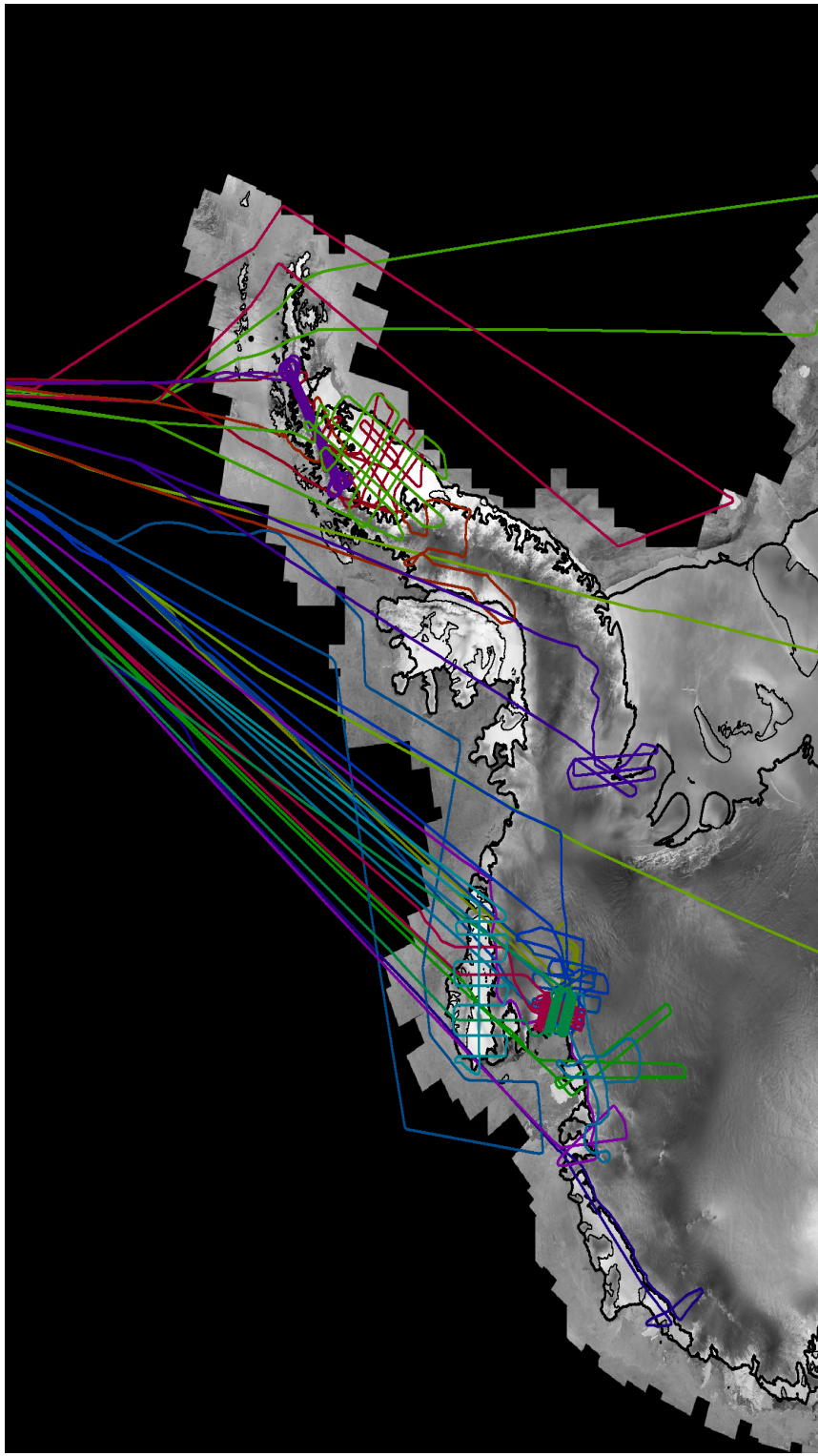

S63°
S66°
S69°
W50°
W60°
W70°
S72°
m
66
49
32
15
-1
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity X
Flight Tracts
Sea Tracts
Jason
Cross Cutting Channels
Separated by Cole
Peninsula High
Kenyon
Cross Cutting Channel
Preliminary
Free Air Gravity
Map
Larsen C
Evidence
Over Deepening
At Grounding Lines
0
100 KM


1000
800
600
300
100
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity X
Flight Tracts
Sea Tracts
Jason
Cross Cutting Channels
Cole
Peninsula High (2-300m high)
Kenyon
Cross Cutting Channel
Up to 1000m deep
Gibbs Ice Rise
Preliminary
Gravity
Inversion
Larsen C
Evidence
Over Deepening
At Grounding Lines
~900m
0
100
200 KM


56 W
68 S
64 S
64 W
Larsen
Butler
100km
0.10
−0.30
m year-1
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity X
Flight Tracts
Sea Tracts
Are Larsen C Channels and Highs… ??
Possibly ---
0 100 200 KM
(Shepherd et al., 2003)

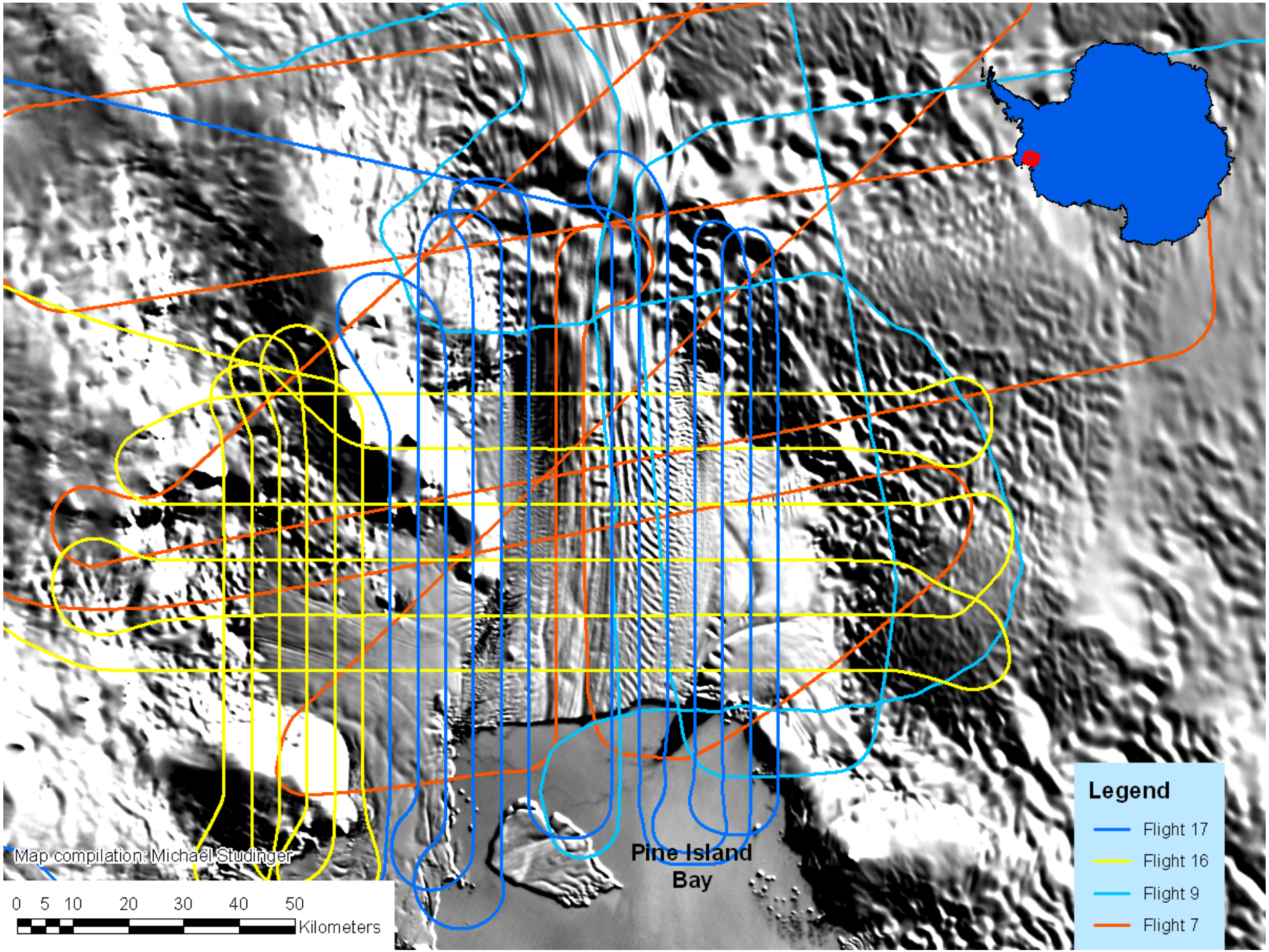
Steps In Developing Bathymetry

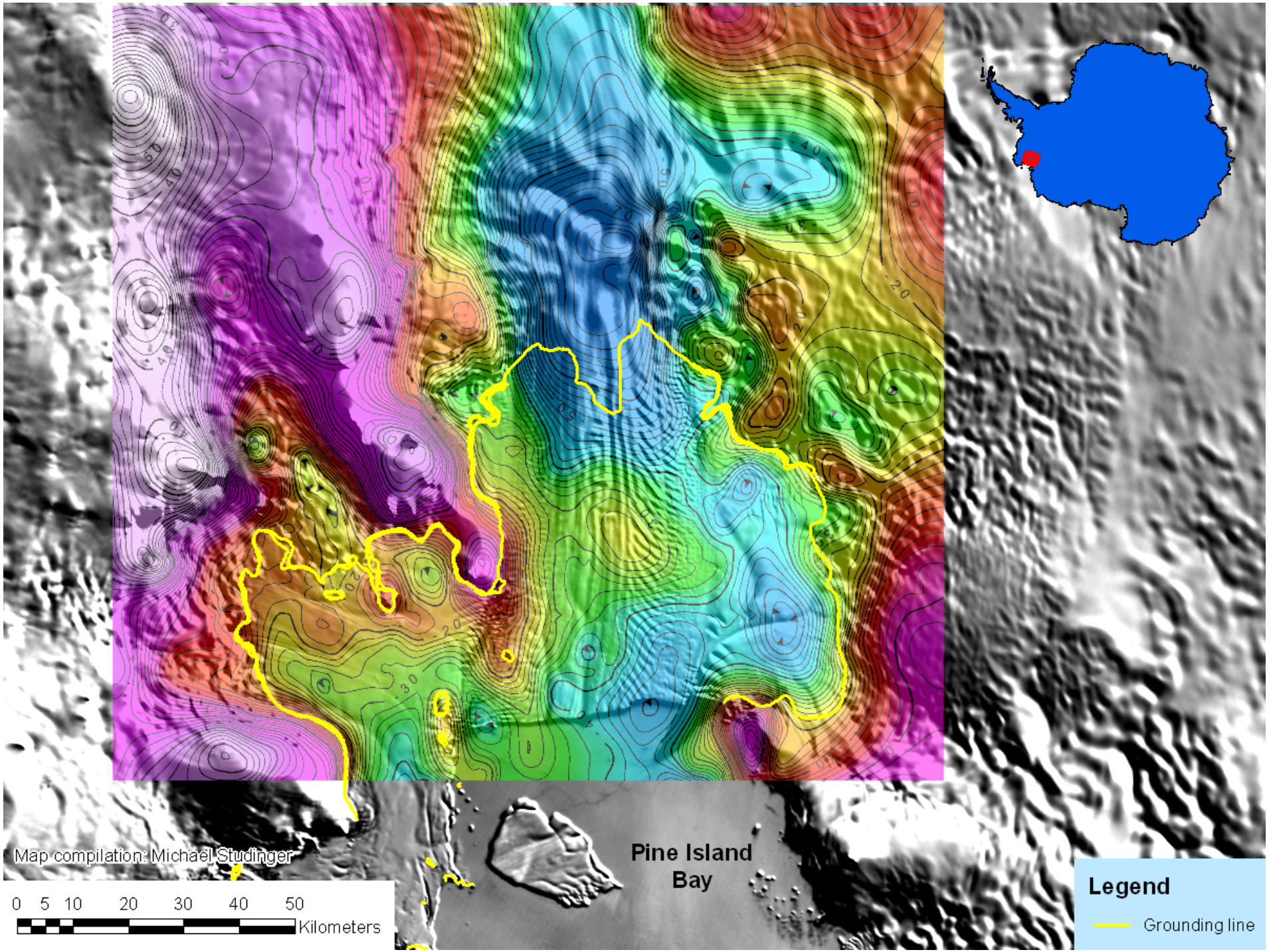
- Simple Models for Weakly Constrained Areas
  - i.e Getz
- Identify Areas With Moderate Coverage
  - Pine Island, Twaites, Larsen, Abbot

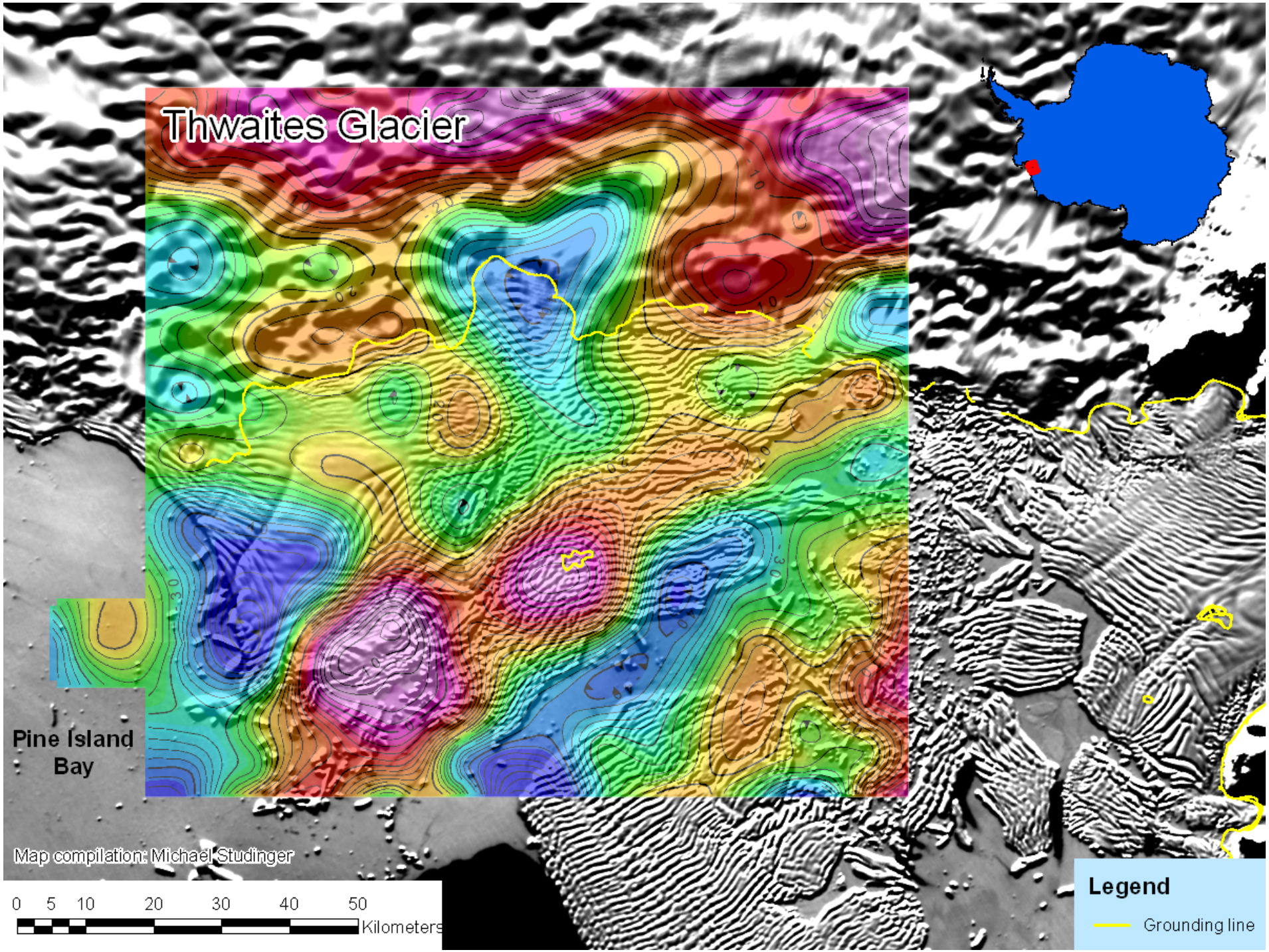


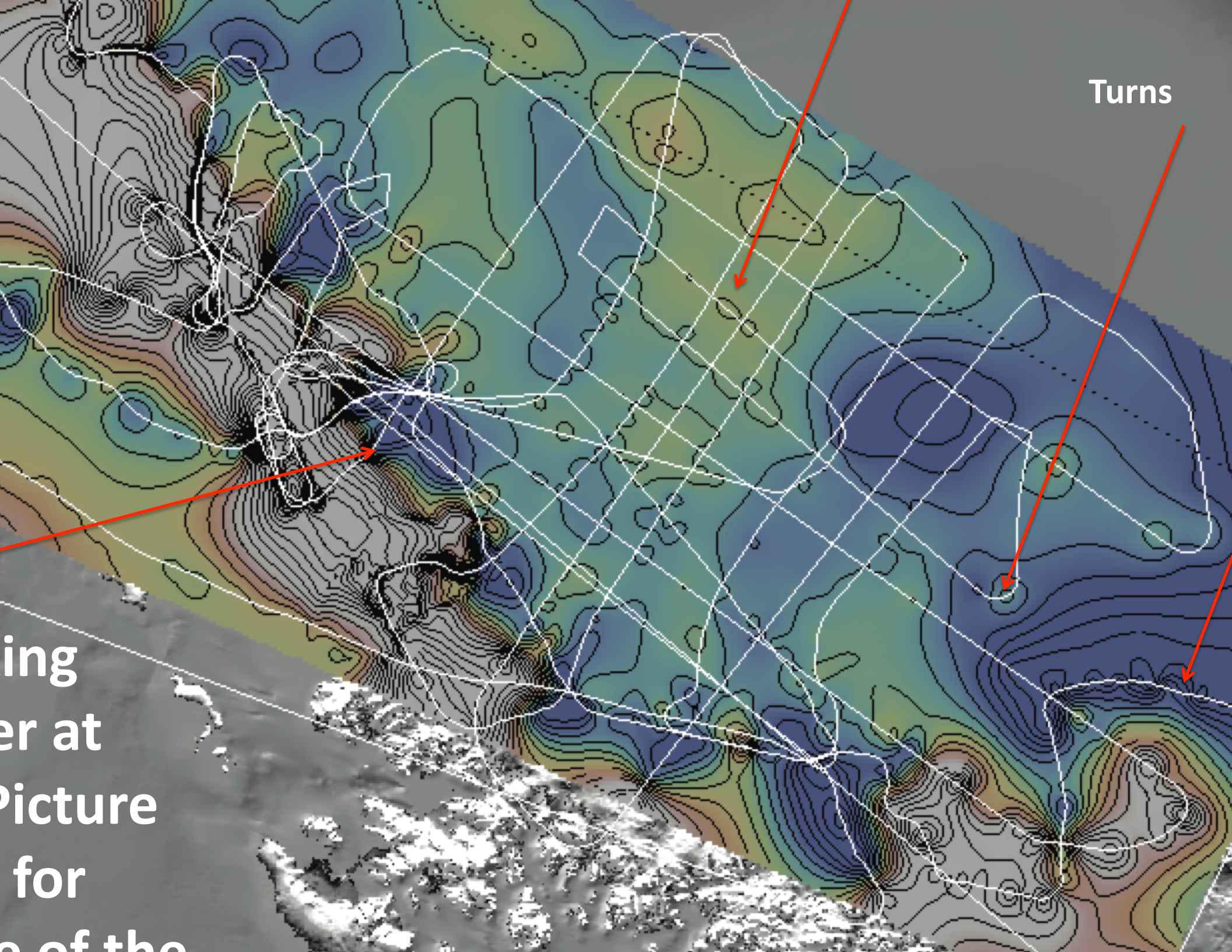
For Inversion Targets

- Assemble All Available Marine
- Integrate Surface ElevationIce Thickness from ICE Bridge When Available Data
- Upward continue data to constant elevation
- If possible use known bathymetry to calibrate – Density Assumptions
- Invert with Error Estimates


Pine Island
Bay
Legend
Flight 17
Flight 16
Flight 9
Flight 7
Map compilation: Michael Studinger
0 5 10 20 30 40 50
Kilometers


Map compilation: Michael Studinger
Pine Island Bay
0 5 10 20 30 40 50
Kilometers
Legend
Grounding line


Thwaites Glacier
Pine Island Bay
Map compilation: Michael Studinger
0 5 10 20 30 40 50
Kilometers
Legend
Grounding line


Turns
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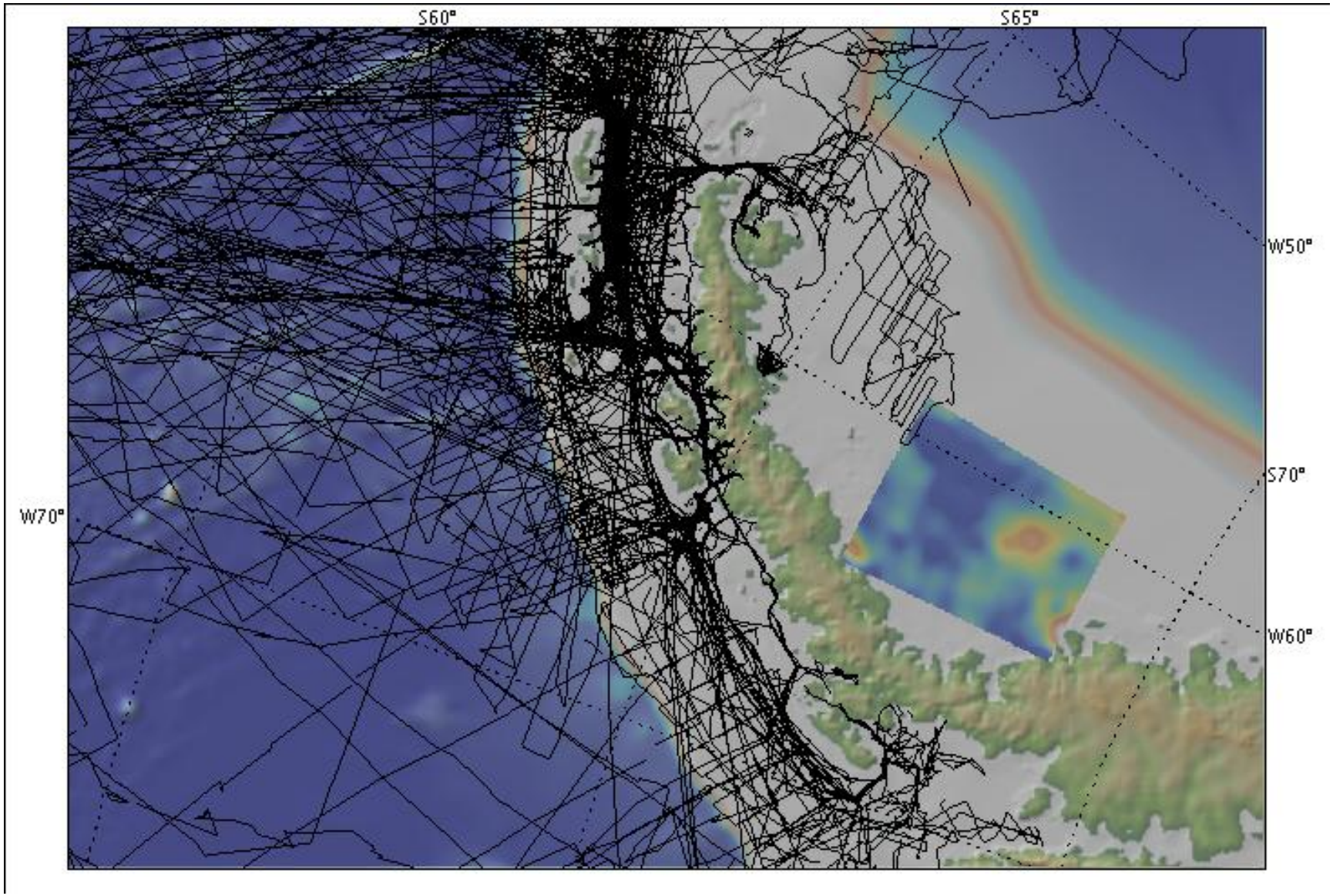
Picture
for

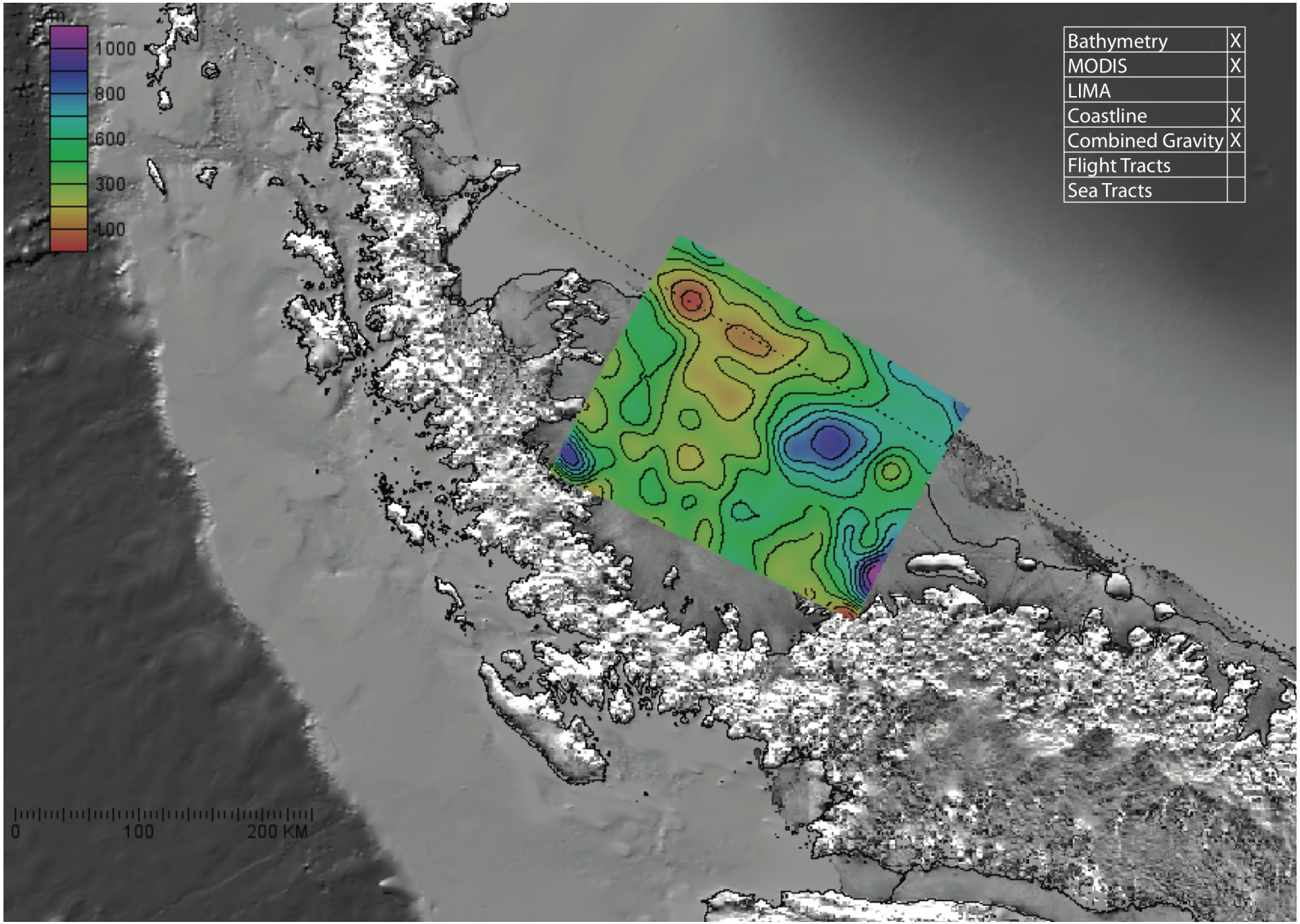
Explore our planet with

GeoMapApp



To be Done ……..

- Decide on Strategy for Products
- Is Preliminary Inversion a Base Line Data Product?
- Reconaisance Flight (Isolated Tracks)
- Grids ---- Survey Design to Produce Optimal Bed for Ice Sheet Models
- Deliver NSIDC Investigate Serving through GeoMapAp


1000
800
600
300
100
0
100
200 KM
Bathymetry X
MODIS X
LIMA
Coastline X
Combined Gravity X
Flight Tracts
Sea Tracts