

Compiling a bathymetry map of the Ross Sea and adjacent Southern Ocean



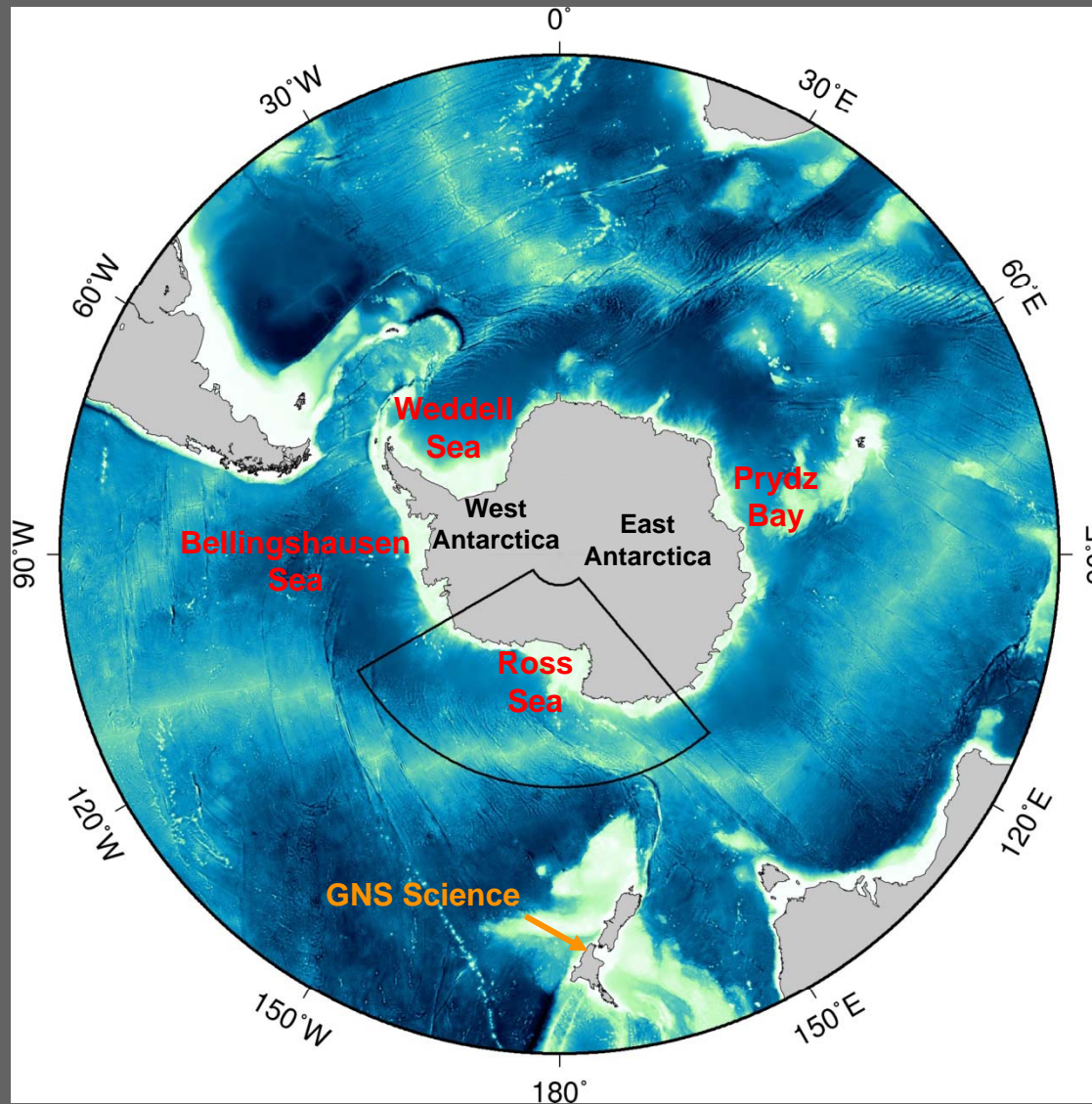
Jenny Black, Derek Woodward, Vaughan Stagpoole, Stuart
Henrys, Fred Davey
GNS Science, New Zealand



Overview

- Where/What/Why
- Bathymetry Data
- Satellite Gravity Data
- Gravity Inversion Method

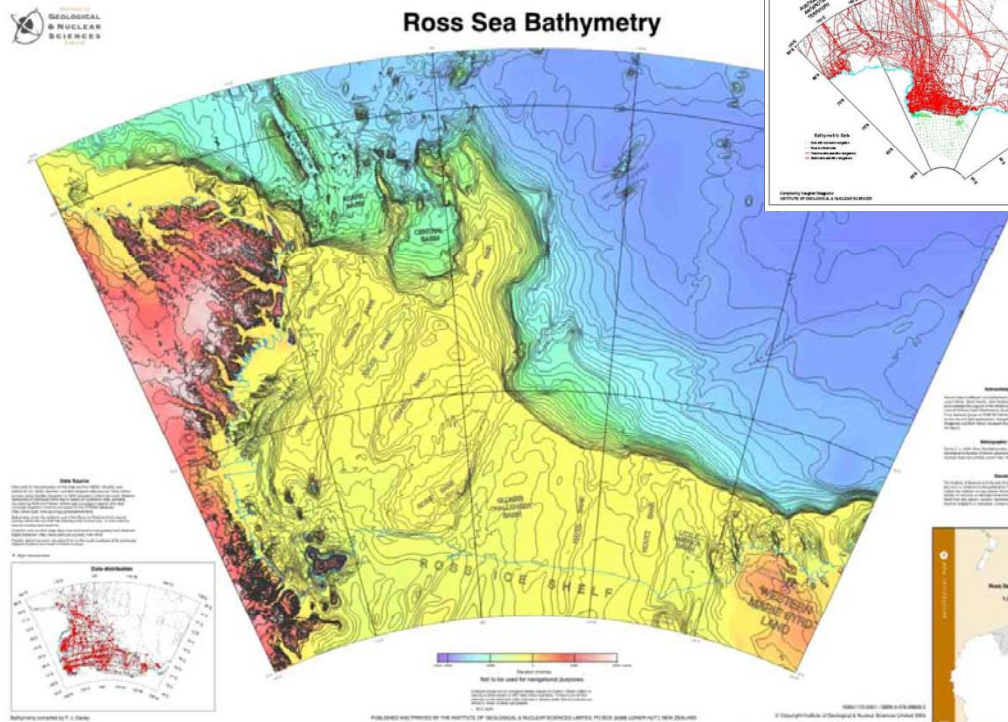
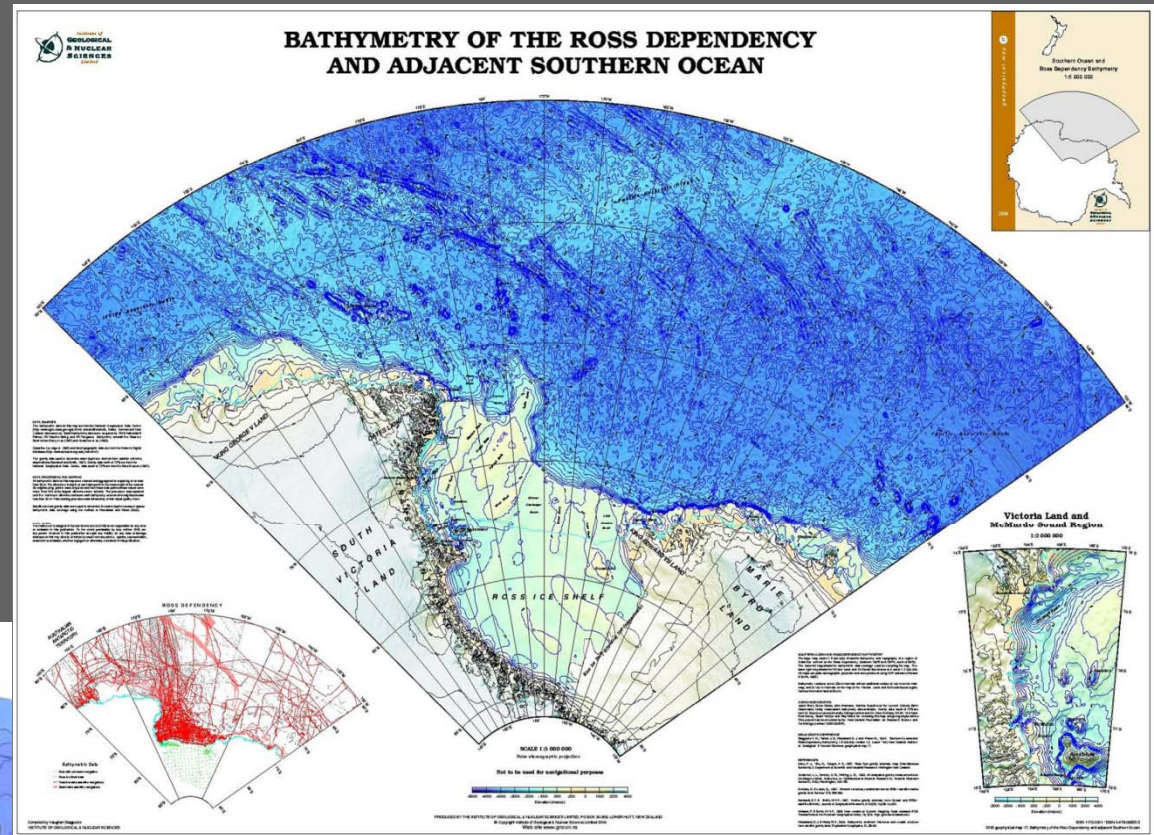
Where? - Ross Sea and adjacent Southern Ocean



What?

- Update 2004 Bathymetry maps
- Map compiled using an inversion of:
 - Ship-borne bathymetry data
 - Satellite Altimetry data

2004 maps



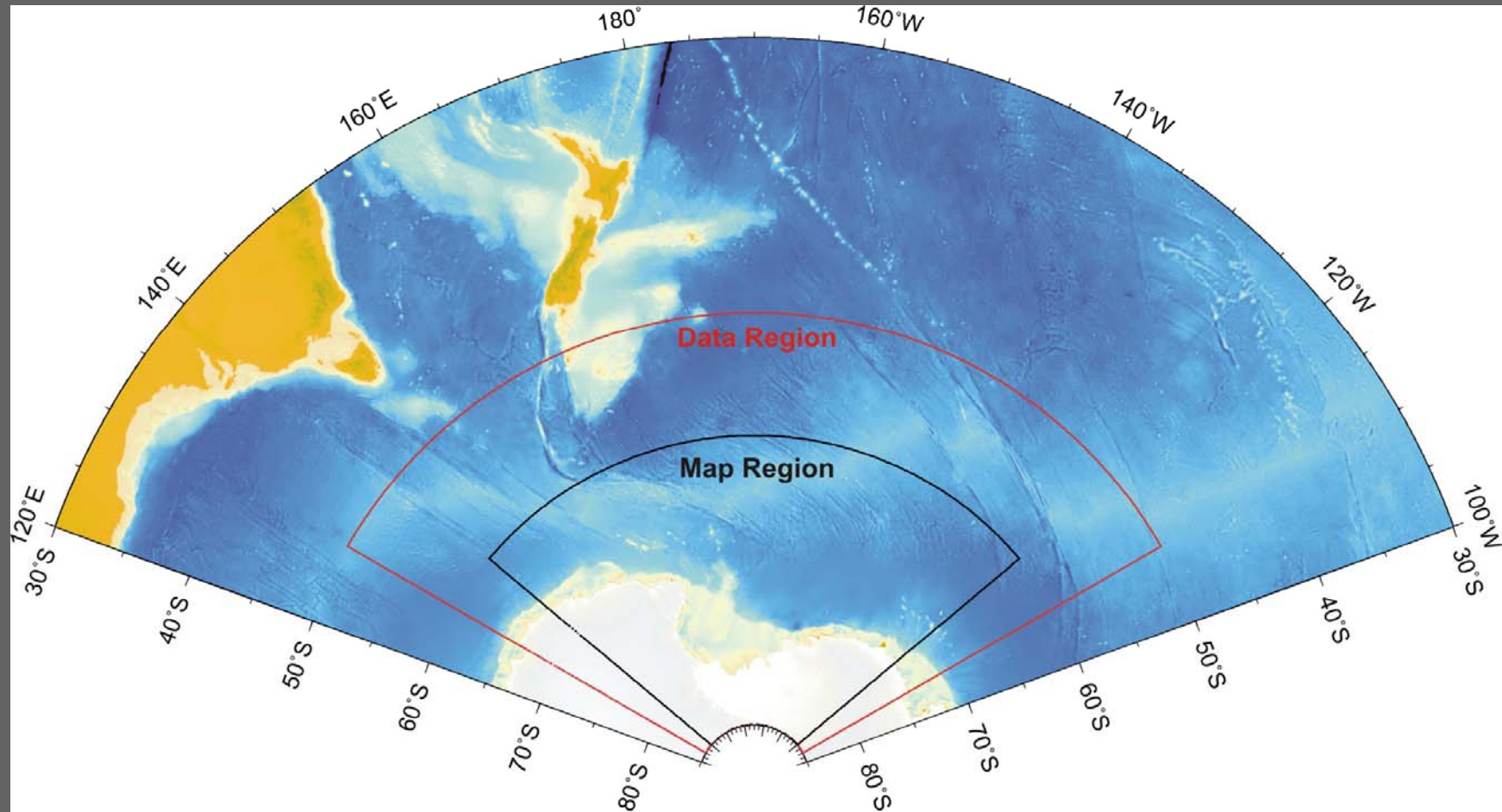
1:5,000,000
(Stagpoole et al. 2004)

1:2,000,000
(Davey 2004)

Why?

- We can improve upon existing maps
- More data available, especially swath
 - Now 50 swath surveys (was 20)
- Better, higher resolution gravity
 - Now 1 minute (was 2 minutes)
- Refined processing techniques

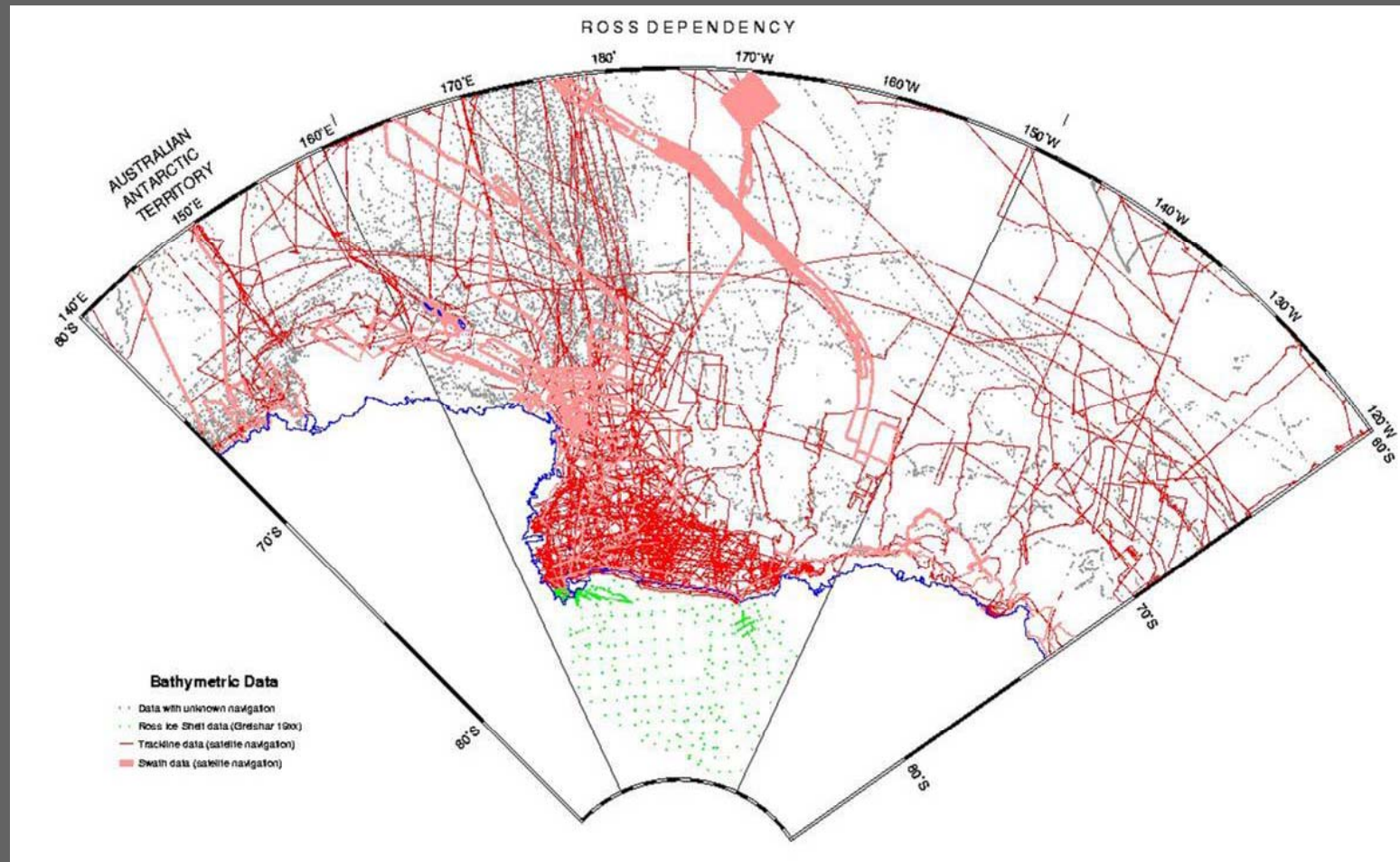
Input Data



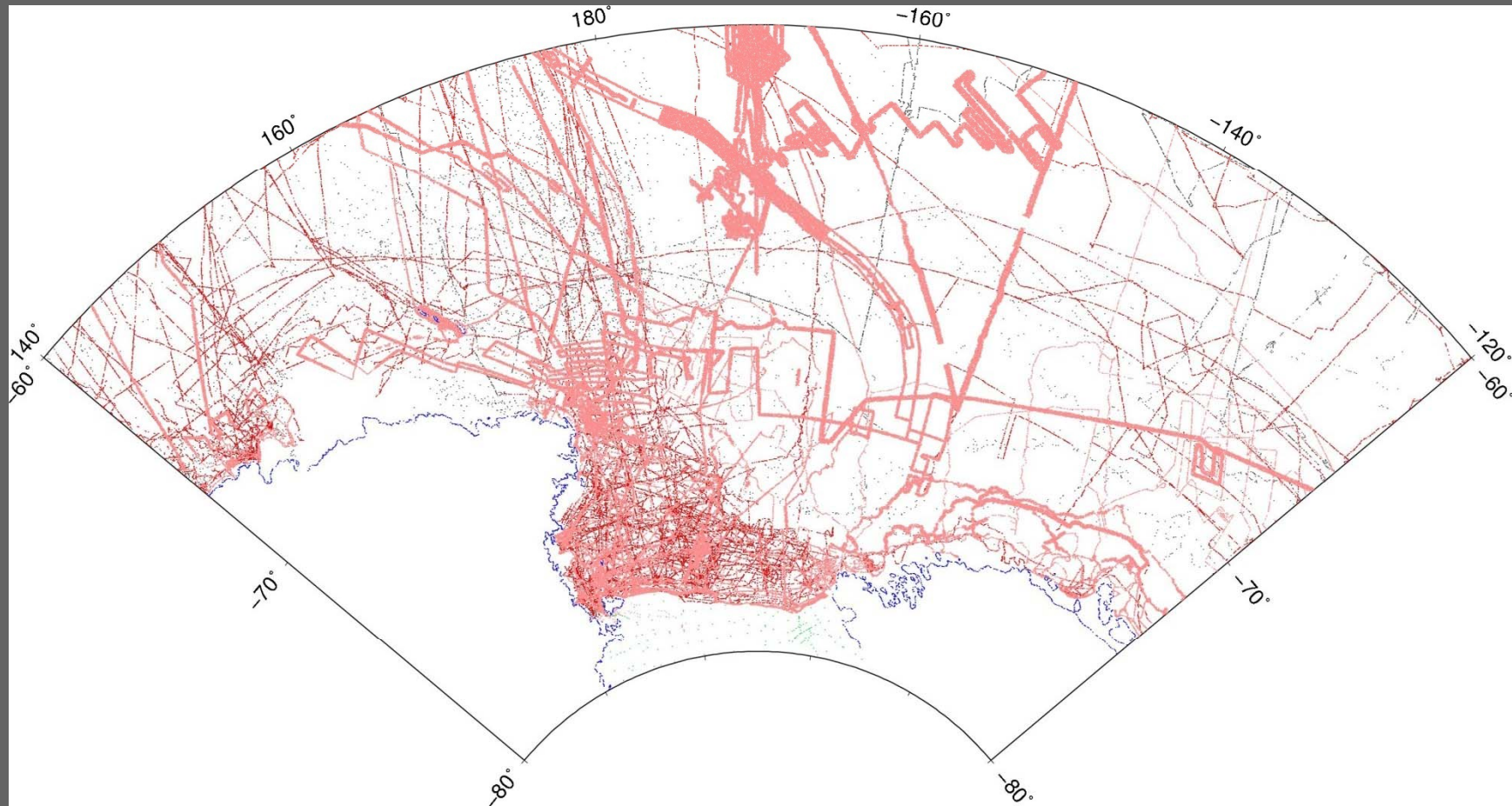
Bathymetry Data - collection

- Swath & single beam
- Time span: 1950s to 2008
- Navigation: celestial to DGPS
- Source: NGDC, AADC, Scripps, LDEO, LINZ, etc
- Blockmean swath at 75m
113,762,058 data points

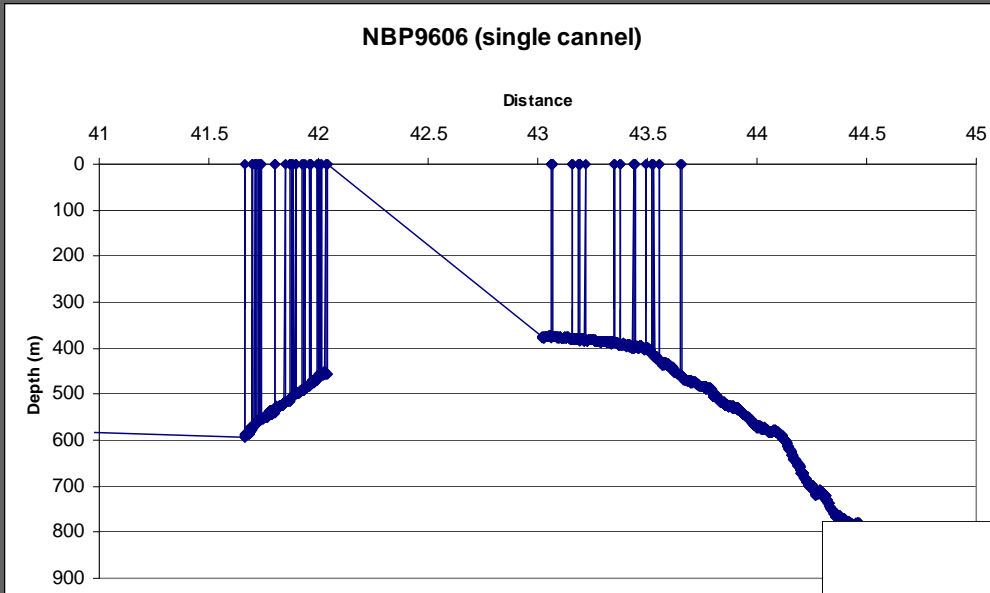
Bathymetry Data – used in 2004 map



Bathymetry Data – used in 2011 map

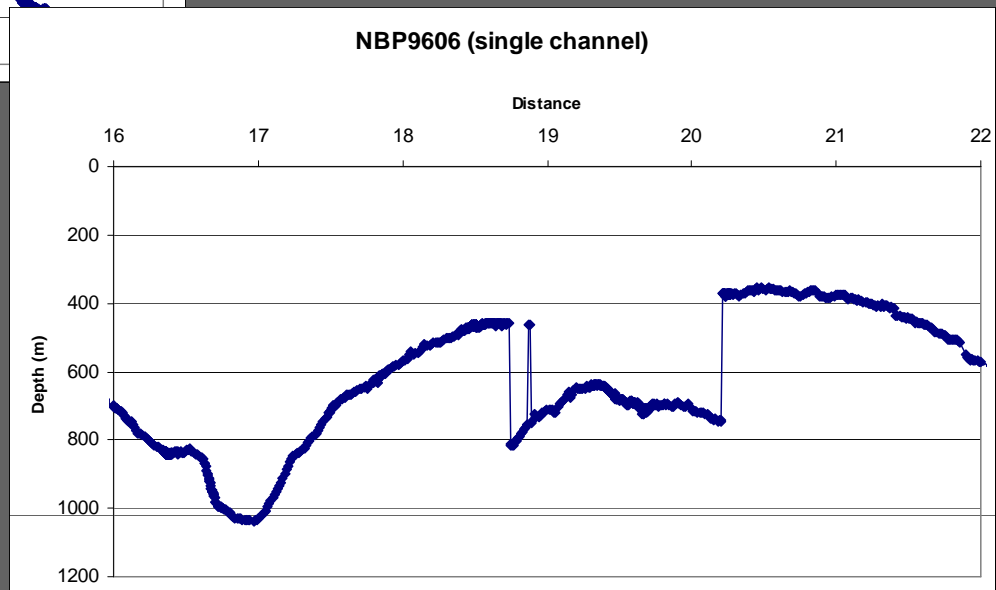


Bathymetry Data - cleaning

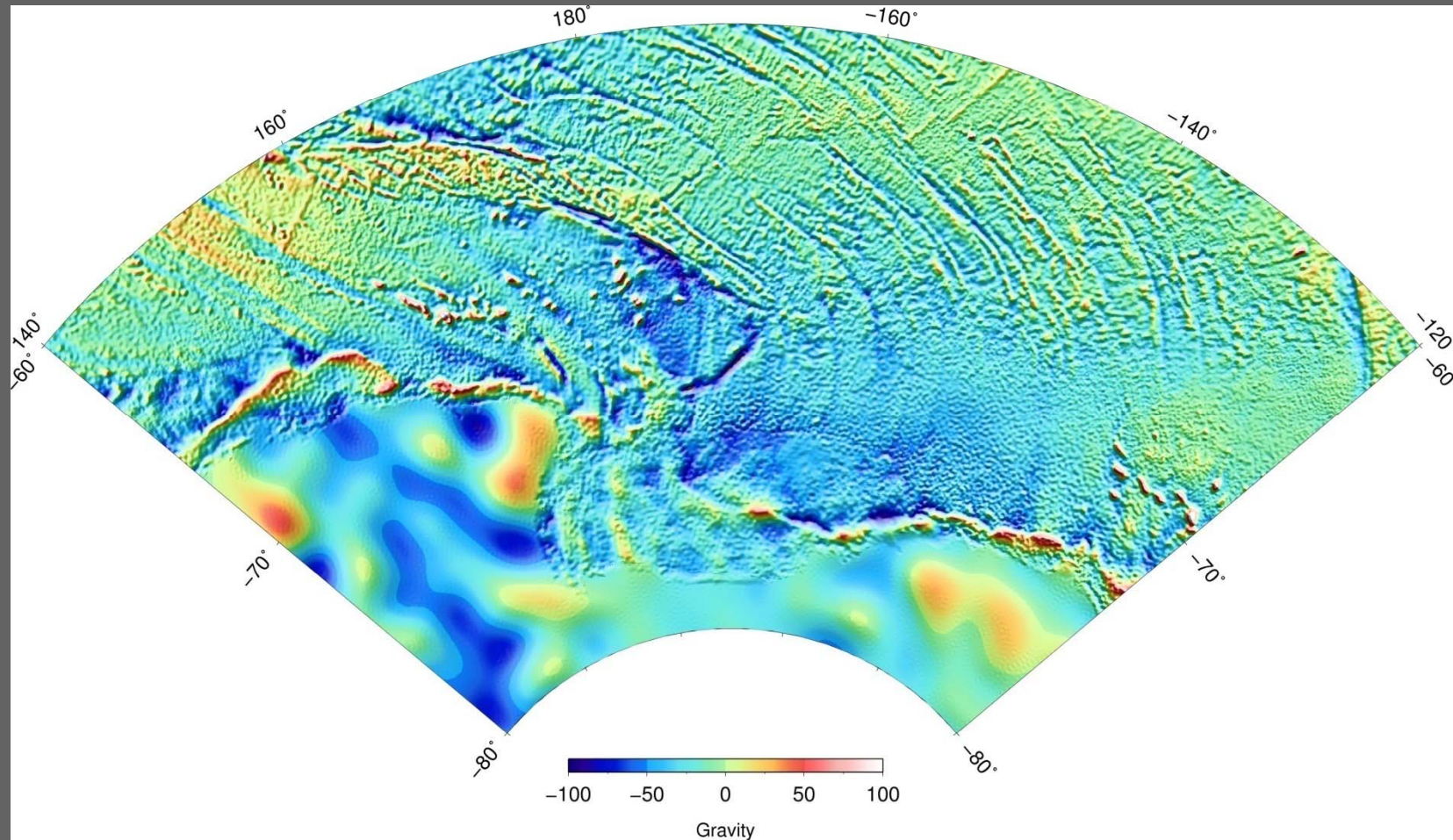


1. Cleaning algorithm

2. Visual check



Gravity Data – DNSC08



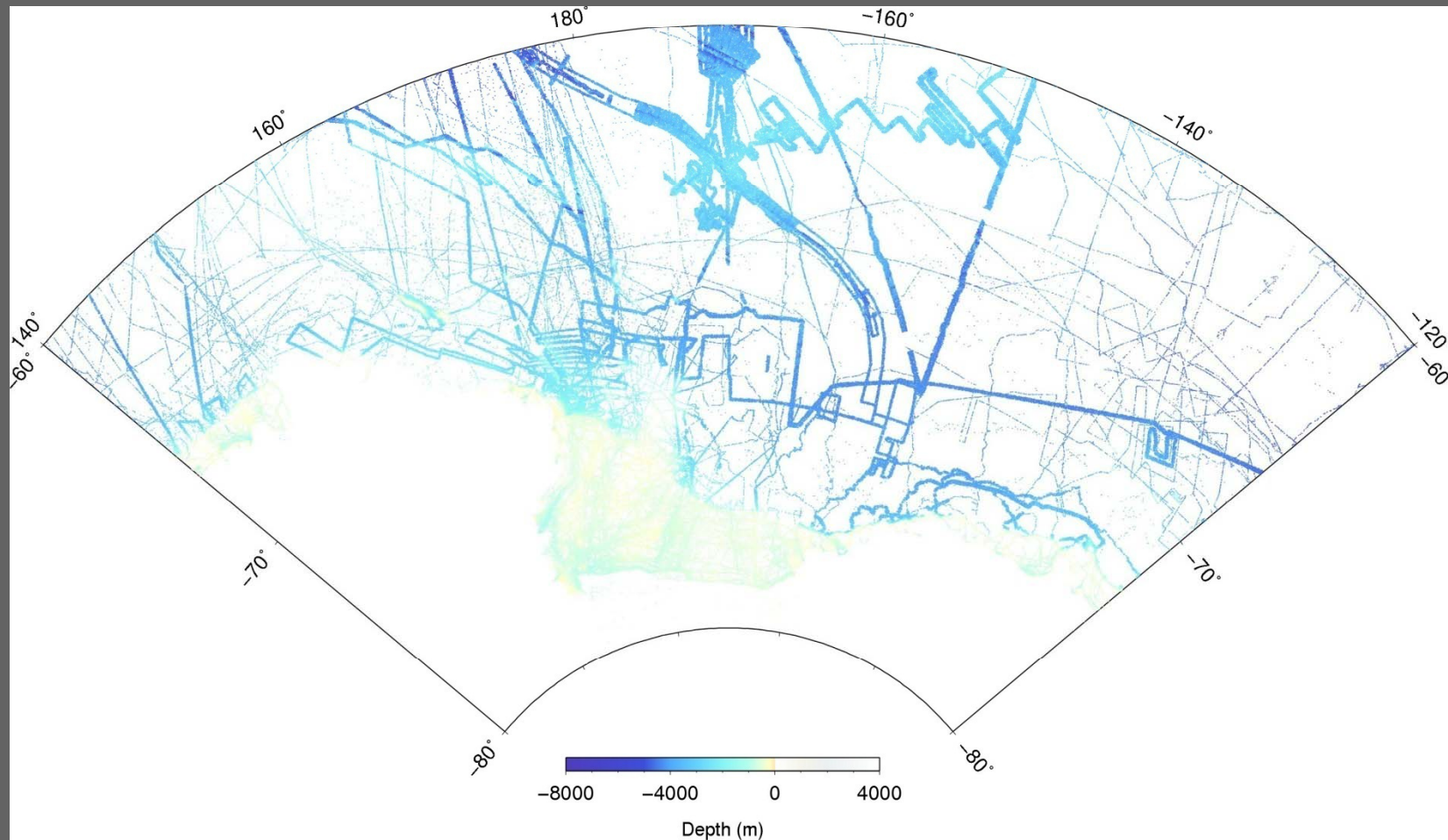
Andersen, Knudsen & Berry (2010)

The DNSC08GRA global marine gravity field from double retracked satellite altimetry.

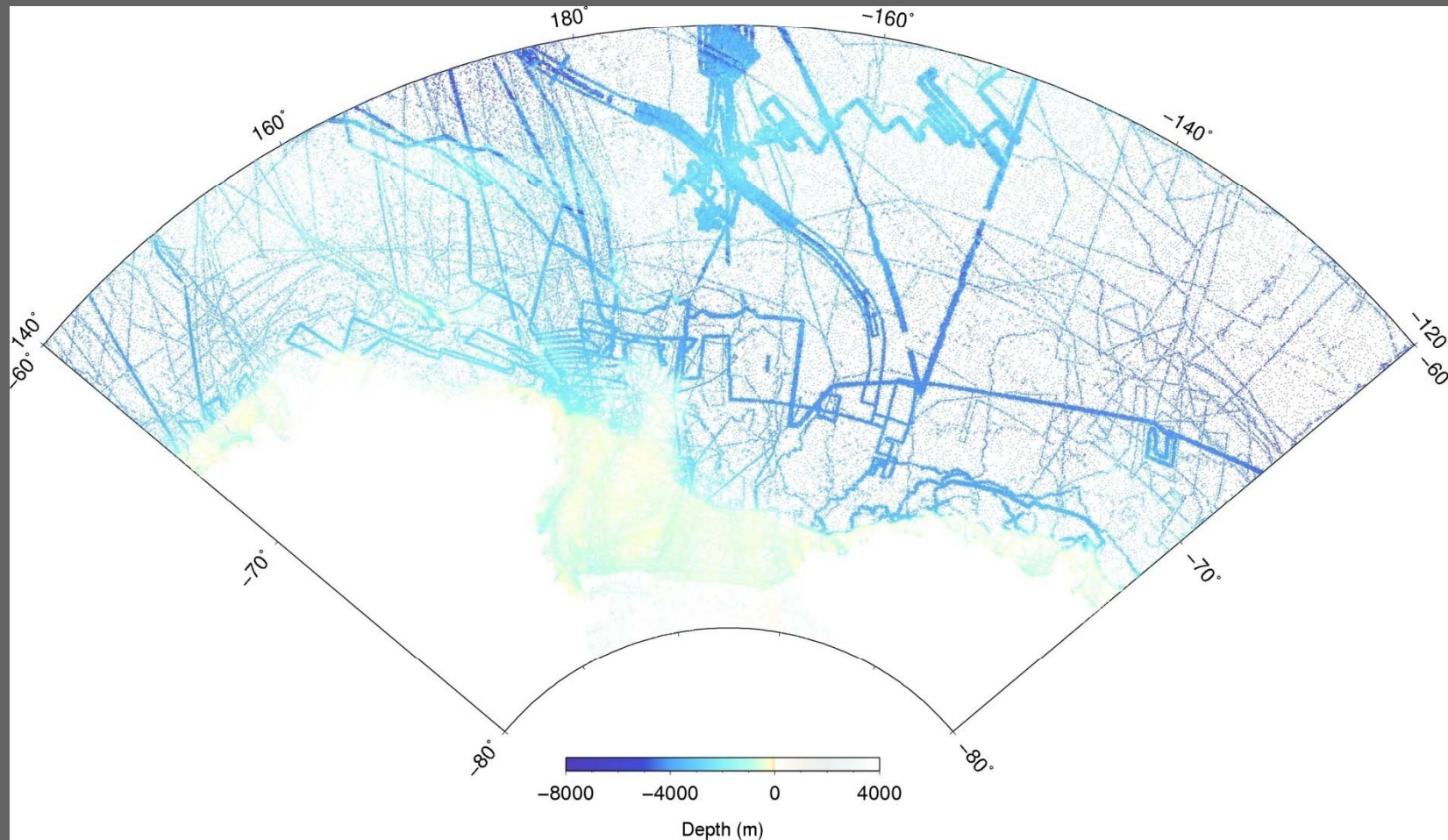
Data Preparation - Bathymetry

- 133,762,058 input points
- Triangular network – sides 1,500 to 10,000m
 - Remove near points => 787,104
 - Add points (not on land) => 886,915

Data Preparation - Bathymetry



Data Preparation - Bathymetry

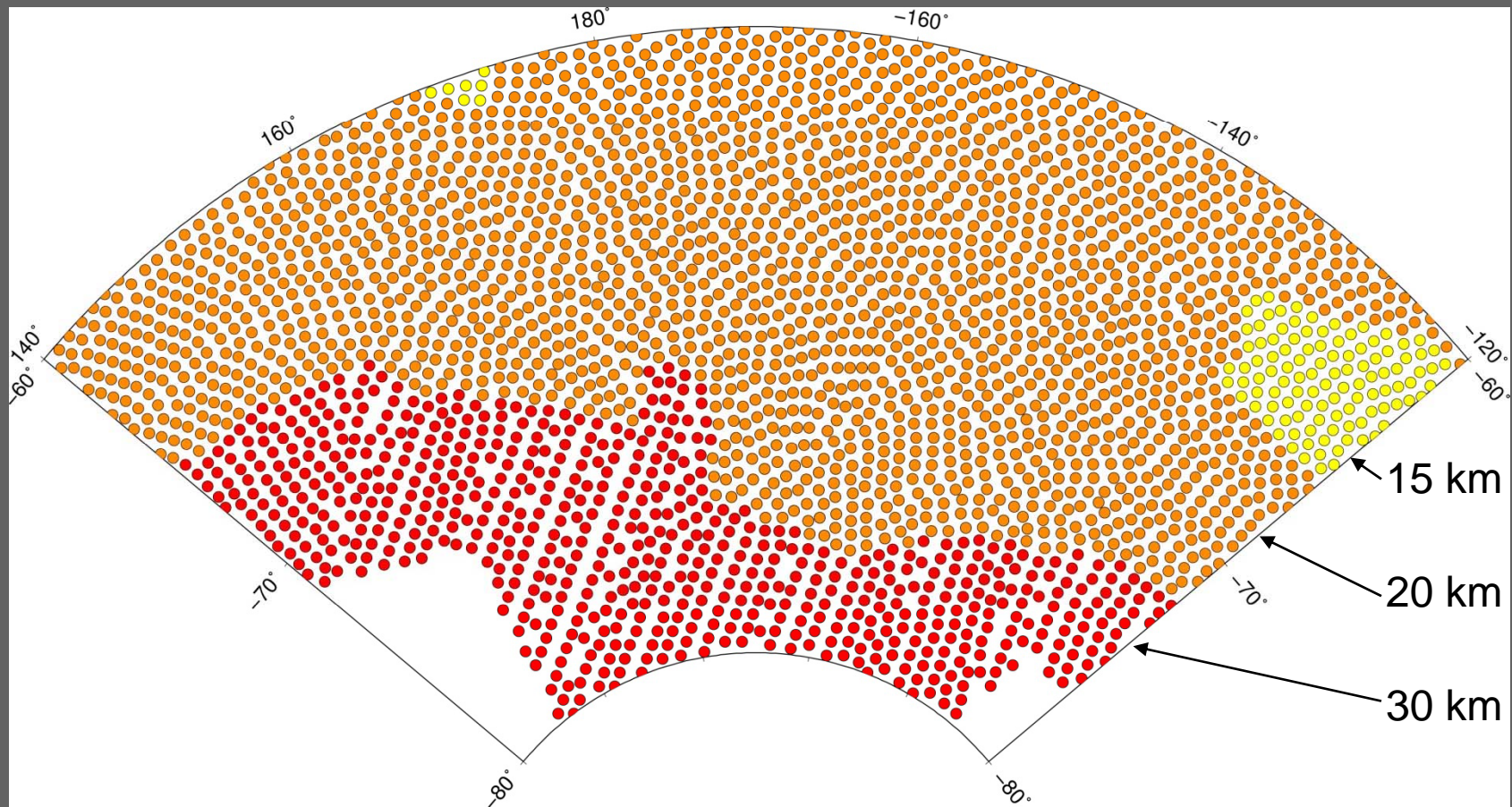


Data Preparation – Crustal Layer

- Includes the effect of:
 - Crustal thickness
 - Crustal density
 - Oceanic/continental crust
 - Sediment layers
 - Crust not in isostatic equilibrium
- Triangular network constructed

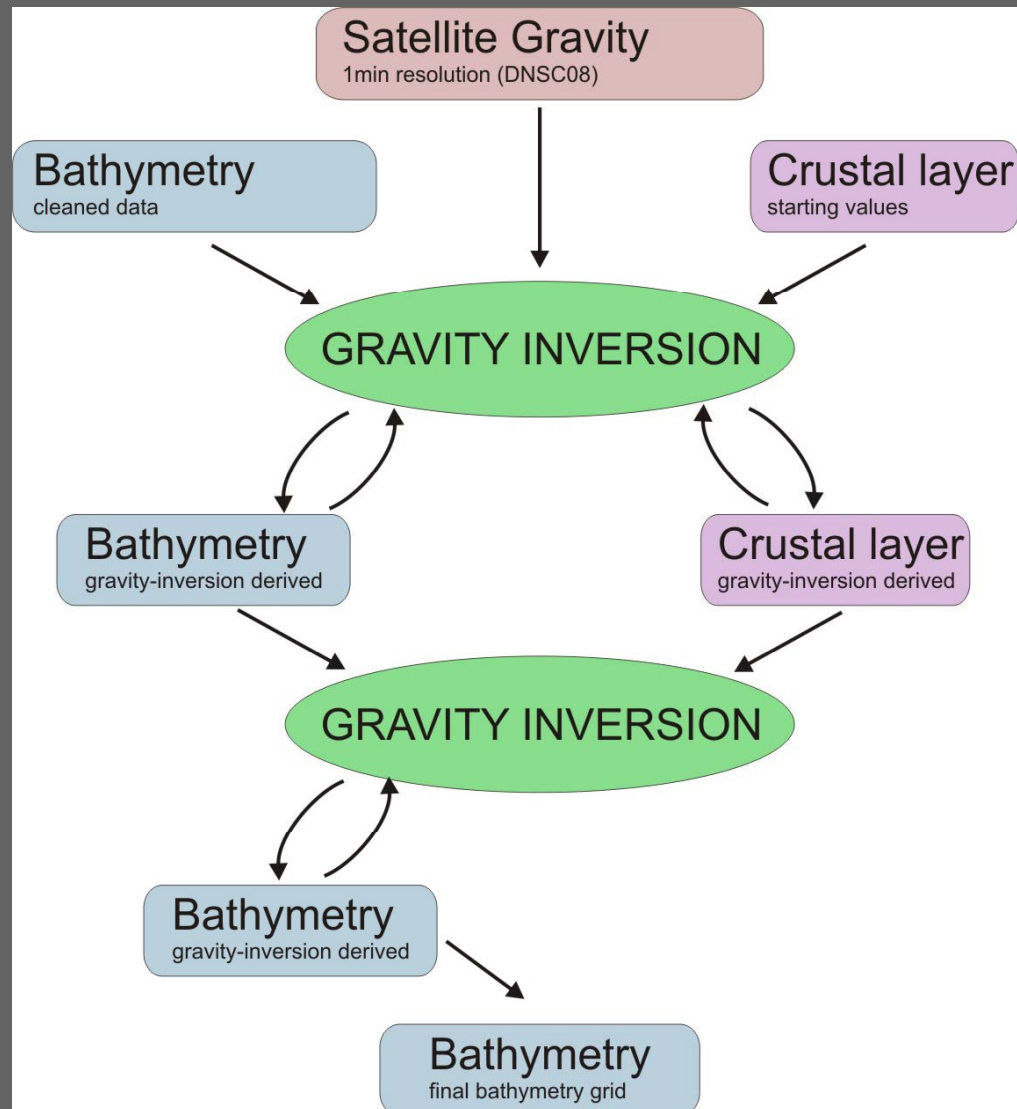
Data Preparation – Crustal Layer

- Starting values



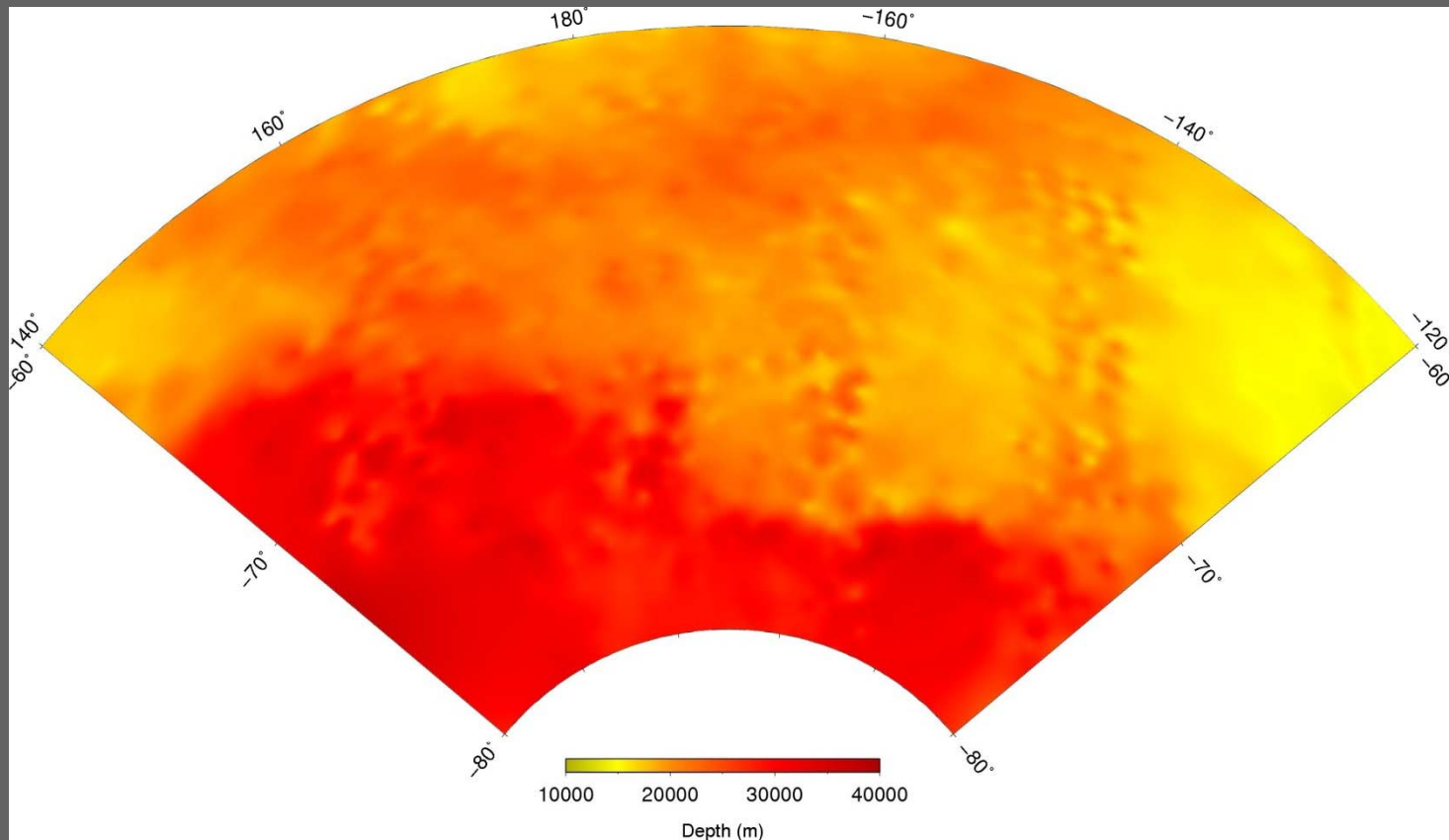
Gravity Inversion - Method

Method and code adapted from Woodward & Wood (Exploration Geophysics 2000)



Gravity Inversion – stage 1

- High smoothing on bathymetry to fix crustal layer
- Iterations



Gravity inversion – stage 2

- Crustal layer is fixed
- Smoothing reduced on bathymetry layer
- Final map is produced

Conclusions

- Final map will be available later this year
- Method is computationally expensive
- Copes well with sediment layers
- Successfully combines bathymetry and gravity data