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

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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

15 km
20 km
30 km

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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