

Development of a new generation gravity map of Antarctica: ADGRAV Antarctic Digital Gravity Synthesis

Robin E. Bell, Christopher Small and Robert A. Arko

Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, U.S.A.

Abstract

The U.S. National Science Foundation (NSF) has agreed to support the development of a new generation gravity map of Antarctica (ADGRAV - Antarctic Digital Gravity Synthesis), funding the development of a web based access tool. The goal of this project is the creation of an on-line Antarctic gravity database which will facilitate access to improved high resolution satellite gravity models, in conjunction with shipboard, airborne, and land based gravity measurements for the continental regions. This database will complement parallel projects underway to develop new continental bedrock (BEDMAP) and magnetic (ADMAP) maps of Antarctica.

Key words *gravity – Antarctica*

The U.S. National Science Foundation has agreed to support the development of a new generation gravity map of Antarctica (ADGRAV - Antarctic Digital Gravity Synthesis). The U.S. National Science Foundation funding will cover the development of a web based access tool and the entry of data as it becomes available. Although this concept is targeted at the gravity field of Antarctica, it must be closely coordinated with ADMAP and BEDMAP (<http://www.nerc-bas.ac.uk/public/aedc/bedmap/finalreport.html>) as well as SCAR. The goal of this project is to develop an on-line Antarctic gravity database which will facilitate access to improved high resolution satellite gravity models, in conjunction with shipboard, airborne, and land based gravity measurements for the continental regions.

The ADGRAV compilation will provide an important new tool to the Antarctic Earth science community, from the geologist needing to place field observations in a regional context to the seismologist studying continental scale mantle structure. A mock-up of the tool is shown in fig. 1. The proposed gravity database will complement the parallel projects underway to develop new continental bedrock (BEDMAP) and magnetic (ADMAP) maps of Antarctica. An international effort will parallel these ongoing projects in contacting the Antarctic geophysical community, identifying existing data sets, agreeing upon protocols for the use of data contributed to the database and finally assembling a new continental scale gravity map. The SCAR Solid Earth Geophysics Working Group offered general support for the ADGRAV concept as an outgrowth of ADMAP during the SCAR meeting in Conception, Chile in July 1998.

The ADGRAV project has three principal facets: data evaluation, tool construction, and building international collaborations.

The first facet will be to investigate the accuracy and resolution of currently available high resolution satellite derived gravity data and quan-

Mailing address: Dr. Robin E. Bell, Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, U.S.A.; e-mail: robinb@ldeo.columbia.edu

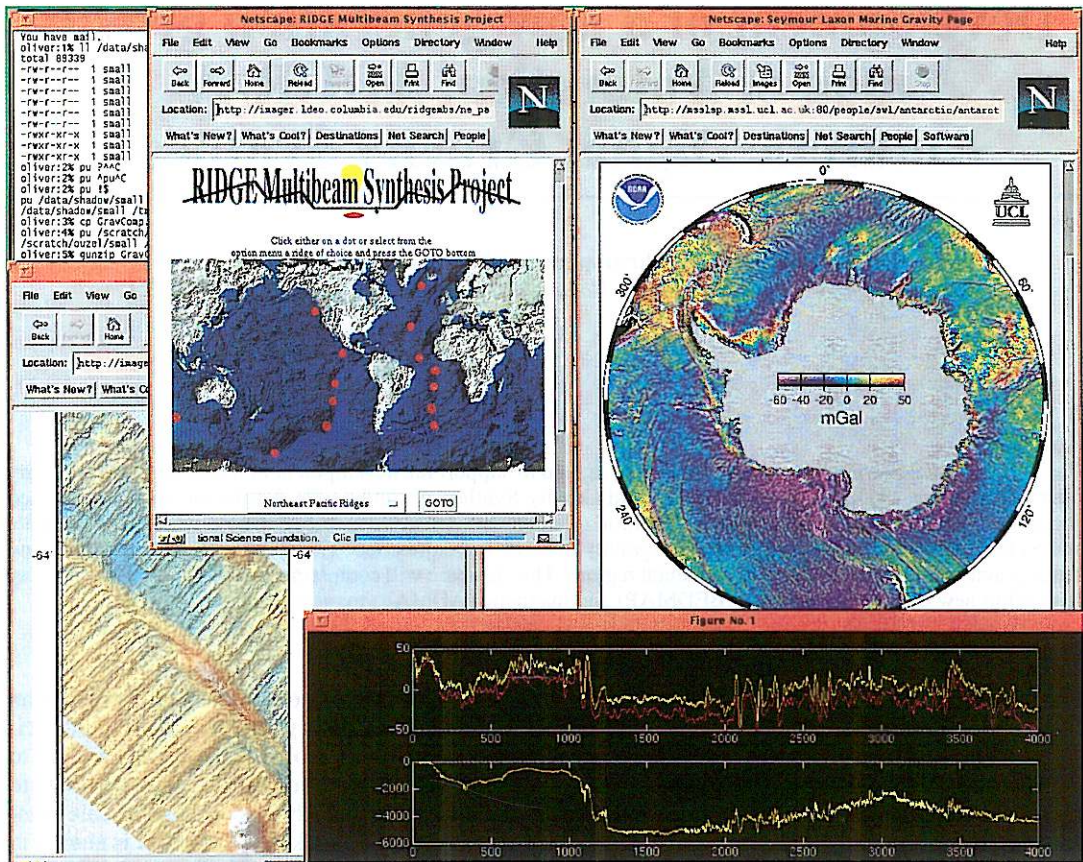


Fig. 1. Example of current tools. The RIDGE Multibeam home page is shown on the left, with a raster image of bathymetry for a selected ridge section beneath it. The global index map enables the user to quickly zoom in on specific geographic regions. Also shown are the tools currently available for manipulating satellite altimetry data. The McAdoo and Laxon home page is shown on the right, with profile plots from the marine database below it. The goal of this project is to produce a single tool for manipulating the Antarctic gravity data similar to the tool available for RIDGE data. The other (visual) void which this project will fill is the large grey area in the altimetry image. The result of the project will be a single image of the gravity field of Antarctica.

tify spatial variations in both accuracy and resolution. High quality, GPS navigated marine gravity data will be used for this assessment as well as for a detailed investigation of the recoverability of short wave length gravity anomalies in the satellite gravity model. In addition, we will use the satellite gravity data to assess the quality of archival, pre-GPS shipboard gravity data by identifying offset anomalies arising from navigation errors.

The second facet of this project will be to develop an interactive method of accessing existing satellite, shipboard, land based, and airborne gravity data via a Web based interface. The Lamont-Doherty Earth Observatory RIDGE Multi-beam bathymetry database will be used as a template for this project (fig. 1). The existing on-line RIDGE database allows users to access the raw data, gridded data, and raster images of the seafloor topography. A similar structure will

be produced for the existing Antarctic gravity data. The primary computing effort to build a robust backend for the storage and access of the data, will be done in close collaboration with the Computer Science Department at Columbia University. The target is to develop a Web based

tool for the ADGRAV effort which will be flexible and fast enough to serve as a practical research tool. The final result will be a tool which will allow easy access to the individual measurements as well as gridded data sets.

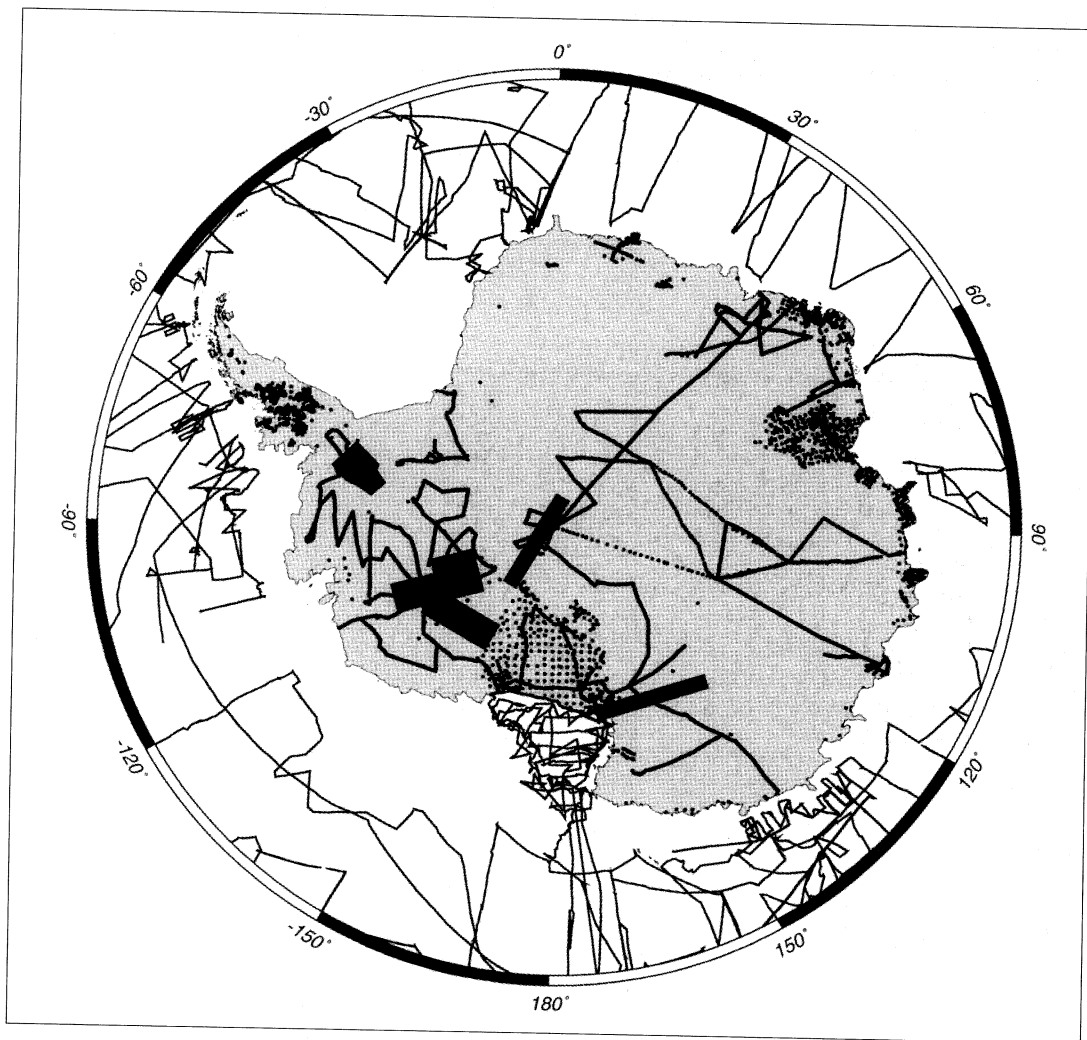


Fig. 2. Preliminary compilation of existing Antarctic data. The data shown here includes the data available from the NGDC CD-ROM, data from the LDEO MG&G database, and aerogeophysical surveys from 1990-1998. A major transect planned for the 1999-2000 field season is also shown, extending from McMurdo to Dome C. A large number of data sets are omitted, ranging from airborne gravity in the Weddell Sea to the major gravity traverse of the EAST93 program.

The third facet of this project will be to develop an international program to compile existing gravity data south of 60°S. This process began by presenting the concept to the ADMAP community during the Fall 1997 meeting at ING in Rome. The concept will also be presented to the BEDMAP community and to the appropriate working groups of SCAR. The goal will be to present a preliminary map of existing data at the Antarctic Earth Science meeting in Wellington in 1999. A gravity working group meeting

will be held in conjunction with the Wellington meeting to reach a consensus on the protocols for placing data into the database. By the end of this project we aim to complete the preliminary basemap based on presently accessible data, identify other existing gravity data, and resolve international protocols for placing data in this on-line database. Figure 2 shows the readily available data from public sources within the U.S. plus some recent work by the British Antarctic Survey.