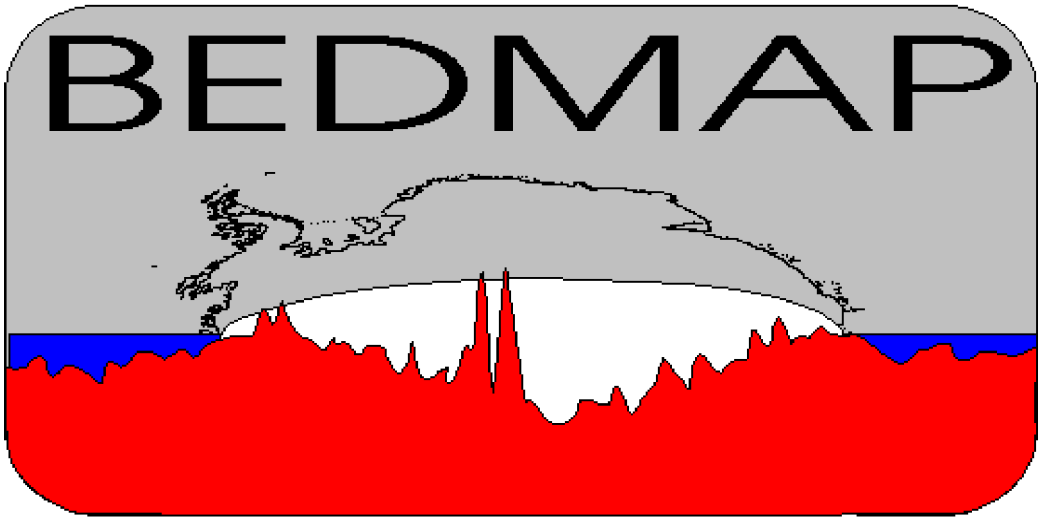
Report of the First BEDMAP Workshop on Antarctic Bed Mapping



Cambridge 21-22 October 1996

Sponsored by:
European Ice Sheet Modelling Initiative
Scientific Committee on Antarctic Research

Contents

Executive Summary

On 21 & 22nd of October 1996, a working group of 21 scientists from eight countries met in the Arundel House Hotel, Cambridge, UK, under the joint sponsorship of the European Ice Sheet Modelling Initiative (EISMINT) and the Scientific Committee on Antarctic Research (SCAR). They met to consider the desirability and feasibility of establishing an international database of ice thickness measurements over Antarctica and from this producing a new topographic model of the bed beneath the Antarctic Ice Sheet and the seabed of the surrounding continental shelf. The workshop achieved consensus on the following points:

- Adequate topographic data is of fundamental importance to many scientific disciplines active in Antarctica, including, ice sheet modelling, geoid interpretation, magnetic anomaly mapping, tectonic interpretation, ice core interpretation, oceanography, global isostasy and sea level prediction

- An outstanding step forward for Antarctic science would be achieved in many disciplines of Antarctic science by the production of a new topographic model for Antarctica

- At present this can only be achieved by bringing together existing data from researchers across the world

- We will endeavour to compile such a database of ice thickness measurements and then this will be compiled to give a variety of digital and map products of value to scientists

- The work will be done under the banner of BEDMAP within the SCAR/GLOCHANT framework. All nations and researchers with appropriate data to contribute will be encouraged to join the BEDMAP Consortium

- A steering committee will direct the project through its three phases, databasing, compilation of data and generation of products

- The products of the BEDMAP project will be published jointly by the BEDMAP Consortium giving due acknowledgement to all participants, with copyright residing with SCAR.

Figure 1. Coverage of data used to compile the SPRI Geophysical Folio Sheet -3 as represented by the number of measurements within each 100 x 100 km cell.

1. Introduction

Antarctica covers an area of some 13 million sq. km, an area rather larger than that of the USA (BAS, 1993). In only around 0.4% of this area is the rock exposed (Fox and Cooper, 1994), the rest being covered by a permanent ice sheet that is in places more that 4500 m thick. The Antarctic Ice Sheet is a major control on world sea level and contains enough water to raise sea level by perhaps 65 m.

In the last ten years mapping the topography of the surface of the Antarctic Ice Sheet has been advanced considerably through field surveying, satellite imagery and satellite altimetry. While mapping is, in places, still limited to scales smaller than 1: 10 000 000 digital maps are now available over the entire continent. Mapping of the true surface of the continent beneath the ice sheet has not, however, kept pace. Whereas present and planned satellites can give an almost complete description of the surface of the ice sheet, neither present nor planned satellites will be able to look through the ice sheet. For the foreseeable future, we are restricted to terrestrial methods of measurement, primarily radar and seismic sounding. The high logistic costs of working in Antarctica have prevented any one nation from attempting to sound the entire continent. Rather, we have seen a largely uncoordinated and patchy coverage develop as many nations produced regional surveys to support their other scientific activities. We are now arriving in a position where no one individual or institute has a complete knowledge of where data have been collected and which areas remain to be visited. Furthermore, bed elevation collected in aid of other scientific disciplines are beginning to be lost as researchers leave the community, and in a short time this will become

too difficult to recover.

The BEDMAP project was conceived as an attempt to rationalise the coverage of ice thickness measurements over Antarctica, collect the data together and produce a new topographic model of the bed of the Antarctic Ice Sheet, to provide a new basis for all aspects of Antarctic geoscience.

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2. Previous bed elevation mapping

Since 1983, one map of bed elevation in Antarctica has been widely adopted. This is Sheet 3 in the SPRI Glaciological and Geophysical Folio Series by Drewry and Jordan (1983). The contours were drawn from ice thickness data collected on sparse surface traverses and by airborne surveys, including a major airborne campaign involving Scott Polar Research Institute, National Science Foundation and Technical University of Denmark, which covered about one third of the continent at 100 km line-spacing. Contours of bed elevation were drawn over the entire continent although in many areas there were more than 500 km between measurements. Figure 1 shows the coverage of data that were used in this compilation in terms of the number of measurements available in each 100 km grid cell.

Despite its limitations and well-known shortcomings, the SPRI Folio Sheet 3 is still a commonly cited publication in papers from a wide variety of scientific disciplines. This is a clear indication that there is a major requirement for bed elevation data within the scientific community. While the SPRI compilation could be considered as the state-of-the-art in 1983, it is no longer adequate and is no longer the best we can achieve. Considerable advances in data and technology will now allow us to make big improvements in the coverage and accuracy of the product.

- new ice-thickness data have now been collected by many nations, covering many of the sectors not visited before 1983.
- Satellite altimetry has almost entirely removed the need to rely on inaccurate barometric altimetry
- Mapping has been refined so that areas that are classified as ice-free can now be easily incorporated into a bed elevation compilation
- Coastal bathymetry has been much improved and can be easily merged with continental bed elevation
- Advanced GIS systems now allow incorporation of many types of subsidiary data into a single determination of bed elevation

3. Scientific benefits

Perhaps the most immediate benefit of BEDMAP will be in the field of ice sheet modelling. Numerical modelling of the ice sheet covering Antarctica is the goal of many researchers and our politicians and taxpayers are expecting these modellers to provide concrete answers to difficult questions about the future ice sheet and sea level. The models are beginning to include far more realistic treatments of the physics involved, but mapping is not keeping pace. And while field workers are collecting new data each year, the modellers often find these too difficult to obtain and too time consuming to handle, with the result that the models are based on old and substandard base data. Indeed, a recent report produced by EISMINT identified lack of adequate bed elevation data as a major inhibitor of progress in ice sheet modelling. BEDMAP will fill this gap and present the modelling community with a variety of easily used maps and gridded data, reducing a major limitation on the models, namely the lack of a realistic map of bed elevation on which the models rest.

The benefits of an improved topography for the continent will not end with ice sheet modelling: as there are a wide range of other scientific disciplines for which it will be a major benefit.

Geology	improved tectonic and structural interpretation
Gravity	improved interpretation of gravity/geoid anomalies.
Magnetics	improved interpretation of magnetic anomalies especially the continent-wide magnetic anomaly map, ADMAP.
Geophysics	improved models of isostasy and sea level
Ice cores	improved interpretation of the flow characteristics upstream of ice core drilling sites leading to improved dating of ice cores.

4. Requirements for ice sheet modelling

The Antarctic Ice Sheet is a complex non-linear system, and it is well known that its overall development can be strongly controlled by local basal conditions. For example, around 90% of ice discharge from the continent passes through a series of ice streams. Some of these lie in geological depressions while others do not appear to be structurally controlled. Ice streams are a major control on how the Antarctic Ice Sheet evolves in time

and yet there is evidence (Retzlaff and Bentley, 1993) these ice streams can be "switched on" or "switched off" in only a few tens of years by subtle changes in sub-ice drainage patterns. Similarly, the evolution of ice shelves is strongly dependent on the distribution of seabed shoals that might act as nucleation sites for ice rises. To mimic reality ice-sheet models should use bed elevation data that takes account of such features wherever possible. Sadly, many of the models presently running are based on bed elevation maps derived from datasets which contained data-holes covering hundreds of thousands of square km. It is likely that entire mountains and basins were overlooked in these early maps.

Contemporary ice sheet modelling can be broadly classified into two types, *fine resolution models* dealing with local areas and concentrating on process studies, and *whole continent models* that attempt to reproduce past behaviour of the ice sheet and give indications about what might happen under future climates. Over most of the ice sheet, the stress driving ice movement in both types of models is approximately

$$J_b \approx D_i \, g \, h \, \alpha$$

where D_i is the density of ice, g is acceleration due to gravity, h is the ice thickness and α is the surface slope of the ice sheet averaged over a length of about 10 km (Paterson, 1994). Clearly the ice sheet thickness has a linear effect on the driving stress, but the response of the ice sheet to this driving stress is non-linear, so that in some areas the local ice flux is proportional to the fifth power of ice sheet thickness. Under these conditions even a small error in bed elevation in the models would result in major errors in ice flux and lead to spurious predictions or ice sheet evolution.

The present generation of *whole continent models* requires a variety of gridded datasets of ice sheet bed / sea bed elevation that cover both the continent and the continental shelf of Antarctica. It seems likely that for most of these models a grid resolution of 5 km will be adequate for the near future.

Fine resolution models require more detailed bed elevation data. It seems unlikely that any single product that could be designed by BEDMAP would be adequate for all these models. What would be of greater value would be for modellers to eventually have access to the original data, in the form of point measurements and digitized profiles. This would allow the generation of bespoke datasets in collaboration with the BEDMAP Consortium

For all models the most crucial areas are close to the grounding line, at the margins where slopes are greatest and ice flow most rapid, in mountain ranges which dam the ice flow from the interior of the continent and on the major outlet glaciers and ice streams through which most of the ice will eventually

pass. It is also clear that to prevent logical inconsistencies bed elevation data should satisfy the following requirements that until now have not been achieved:

- Include both ice thickness and sea bed elevation in areas covered by ice shelves
- Extend to the edge of the continent shelf at constant resolution
- Be self consistent regarding the three parameters, surface elevation, bed elevation and ice thickness
- Correctly predict the ice to be at the flotation limit near the mapped grounding line.

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5. Status of Ice thickness measurement

Many countries and institutes now have the capability to measure ice sheet thickness, both by radar and seismic sounding and many are actively engaged in collecting new data on a yearly basis. BEDMAP should serve two specific functions, a. to prevent duplication of effort by directing fieldwork towards areas not previously covered, and b. provide a framework for the cross matching of overlapping datasets.

A poll conducted at this workshop showed that as of 1996 only a small part of Antarctica is lacking basic, reconnaissance level ice thickness data. Appendix 10 contains a catalogue of known datasets collected during the workshop.

It was noted that, while there are an increasing number of seismic and radar sounding measurements, these do not represent the full state of knowledge and at the compilation stage BEDMAP should consider all sources of useful data

- Ice sheet thickness
  - Airborne radar sounding
  - Oversnow radar sounding
  - Oversnow seismic sounding
  - Rock outcrop data
  - Borehole data
  - Gravity measurements
- Ice sheet surface elevation

- ERS-1 altimetry
- Airborne and oversnow altimetry
- Map/survey data for the mountainous regions

! Sub-ice shelf seabed

- Oversnow seismic data

! Bathymetry over continental shelf

- New compilations of bathymetry

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6. Geographic framework

There now exists a good geographic framework on which to base the BEDMAP project, this is the Antarctic Digital Database (BAS, SPRI & WCMC, 1993), which is available to the entire Antarctic community on CDROM through the SCAR Secretariat, Cambridge.

One of the major problems during the compilation of ice-thickness data will result from navigational inconsistencies. Although most data collected since the mid-1980s have used GPS and so are relatively well fixed with respect to an ellipsoidal reference frame (usually WGS84), data collected before this was not so well fixed. Many methods of navigation were employed, including astronomical fixes, dead reckoning, inertial avionics and Doppler avionics, where each technique has its own sources and propagation routes for error. In addition, many of the ice thickness data were fixed to maps that are now known to have inaccurate control. During the compilation phase a major effort will be needed to evaluate and where possible correct these data.

In addition, to providing a framework for the compilation the ADD map data contains feature types that are more directly relevant to BEDMAP. Areas of rock outcrop define areas of zero ice sheet thickness and so can be included in the compilation of ice thickness. Where map contour lines cross exposed rock, the elevation of these contours should be taken directly as the ice sheet bed elevation.

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7. Digital Elevation Models

Before the introduction of satellite positioning systems and satellite surface altimetry the surface of the Antarctic Ice Sheet was mapped using barometric techniques. These techniques are notoriously prone to error and during the compilation of the SPRI Glaciological and Geophysical Folio it was

recognised that the surface elevation data contained significant errors. Now that field observations are fixed using satellite positioning systems and satellite altimeters can provide orthometric heights over most of the continent where surface slopes are low, it is possible for us to discard those unreliable surface elevation measurements in favour of a revised digital elevation model.

Several DEMs derived from satellite altimetry are presently available, but it seems likely that once in the compilation phase BEDMAP will need to use the best available DEM derived from several sources

- ERS-1 Satellite altimetry in areas of low slope
- Airborne measurements south of the orbital limit of ERS-1
- Map data in rugged areas

There will be a discussion at the second BEDMAP workshop as to whether any existing DEM is adequate for the compilation or whether a new DEM will have to be commissioned.

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8. Project schedule

Discussion during the workshop led to the BEDMAP project being divided into 3 phases:

8.1 **Phase - 1 Data collection and storage** (10/96-10/97)

It was decided that during Phase 1 of the project, data would be collected together from the institutes involved and stored together with their metadata. Only digitised/interpreted data would be collected, either as isolated soundings or tracks with soundings along them. Transfer to data storage sites would be through FTP, floppy disks or DAT tapes, with files written in ASCII format.

Initially, data will be collected and stored at two centres, BAS and CRC. At some later date it may become neccessary to split the data into geographic areas to facilitate compilation, but this will be avoided if possible.

The IHO (Monaco) and AUSLIG have already begun to collaborate within the BEDMAP framework on a new compilation of bathymetry on the Antarctic continental shelf and this will be pursued in parallel during Phase 1, with a view to it being ready for incorporation with

the other data in Phase 2.

Specific activities are to include

- Report of first BEDMAP workshop
- Specification of metadata required to characterise ice thickness data
- Collection of ice thickness data by BAS and CRC to be completed before 1/6/96
- Preparation of a poster for the symposium on Antarctica in Global Change (Hobart 1997)
- Identification of other datasets (eg. Borehole data, seismic data, gravity data)
- Make a general plea for other data to be brought to the attention of BEDMAP
- Investigate ways to "rescue" the original data for surveys that are likely to be lost in the near future
- Consider sources of funding for Phases 2 & 3
- Organise second BEDMAP workshop
- Compile bathymetry on Antarctic continental shelf (IHO & AUSLIG)

8.2 **Phase - 2 Data compilation** (10/97 - 10/98)

Evaluation and compilation of the data will be the most time consuming and labour intensive part of the programme. Where this activity will take place has not yet been decided and may indeed happen at more than one institute.

- Evaluation of ice thickness data (cross over analysis and re-fixing)
- Evaluation and acquisition of best available coastline data
- Produce surface elevation DEM from satellite altimetry, map data

- Evaluation of geoid model and acquisition of the best available

- Produce grid of ice sheet bed elevation across Antarctica and continental shelf

- Consideration should be made at this stage for maintaining BEDMAP as a long-term database

8.3 **Phase - 3 Product generation** (10/98 onwards)

Specification and generation of the final BEDMAP products will be a fairly routine once phase 2 is completed. It may, however, require the acquisition of specific funds to complete.

- Production of gridded datasets

- Production of hardcopy map

- Publication of keystone paper by the BEDMAP Consortium

9. Project management

To implement the plan described in this document the group decided that a BEDMAP Steering Group should be formed comprising, David Vaughan, Janet Thomson, Ian Goodwin and Sergei Popov. The steering group will report regularly to the rest of the BEDMAP Consortium on progress in the project. An offer by the CRC to establish a BEDMAP homepage and contact point on the World Wide Web under the GLOCHANT entry, was warmly accepted by the workshop.

To be a truly valuable exercise, BEDMAP should aim to include as much data as possible. The project will stand or fall depending on the breadth of participants that it attracts and to encourage cooperation, preferential access to the final products will be given to the participating workers. Although local surveys are of little value in terms of broad-scale mapping, taken with other data they can make a significant contribution to the larger picture. BEDMAP will thus encourage participation from any researcher or institute with appropriate data to contribute.

10. Recognised obstacles

It was anticipated that problems may arise for BEDMAP, and some of these were discussed at the workshop.

It was recognised that since new data are being collected on a yearly basis BEDMAP can never be entirely complete. BEDMAP should simply collect all the data on offer and at an appropriate time generate its products. Updated versions of the products could then be generated as new data became available.

It was recognised that some institutes would need to publish their data under their own name before they could be made available to be included in BEDMAP. In order to speed this process and thus make data available as early as possible assistance may be sought from other BEDMAP partners to aid in the publication process.

11. Funding

Since BEDMAP proposes to collect no new data the only requirement for funding would be towards the direct costs of collaboration, data manipulation, publication and dissemination. It is anticipated that no dedicated funding would be required to complete Phase 1 (databasing), but it

is likely that some funding will be neccessary to support Phases 2 and 3. At present it is not clear what level of funding would be required to support these activities, or even at which Institute the work will be done. During Phase 1 the steering group will investigate suitable sources. In the meantime an application would be made to EISMINT to fund a second BEDMAP workshop in late-1997. The purpose of this workshop would be to assess the progress made on Phase 1 of BEDMAP and establish the way forward for Phase 2.

A number of funding bodies have, however, already be identified.

- EISMINT
- European Union - Framework V
- US NSF
- European Centre for Earth Observation
- SCAR
- European human mobility fund

In an ideal world, adequate international funding would be available to support BEDMAP, but this is not the case and it is likely that the project will have to proceed by the enthusiasm of the participating researchers. However, there was no objection to individual workers using participation in BEDMAP as the basis for funding proposals. Indeed, BEDMAP will provide letters of support where these proposals are scientifically sound.

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12. Final products

There are a variety of possible forms for the final products:

- Hardcopy map to be published by BEDMAP consortium and/or SCAR
- Gridded dataset at various resolutions for modelling
- Internet accessible flight line database
- Publication in quality journal or cornerstone paper by BEDMAP Consortium
- CD-ROM

The exact choice of products has not yet been made but will be reconsidered at the second workshop.

13. Conclusion

The primary outcome of the workshop was consensus that BEDMAP is a worthwhile and feasible goal that should be pursued. All present at the workshop expressed a wish to be involved in BEDMAP at some level, contributing data in one form or another and then participating in the compilation and product generation. A program which includes several concrete goals has been set out for the next year and agreed. A commitment to meet again has been made.

14. Acknowledgements

We would like to thank the SCAR Working Group on Glaciology for their spiritual support in making recommendation Glac-XXIV-2, and the European Ice Sheet Modelling Initiative for their concrete support in funding the first BEDMAP workshop. Phillipa Pirra of the European Science Foundation and Kathy Salisbury of British Antarctic Survey played a large part in organising this workshop.

APPENDICES

APPENDIX 1. The SCAR recommendation

At the XXIV Meeting of the Scientific Committee on Antarctic Research, the Working Group on Glaciology made the following recommendation (Glac-XXIV-2)

Noting:

1. *that numerical ice sheet models with realistically proscribed bedrock elevation and other boundary conditions are required to interpret and predict ice sheet changes; and*

2. *That many National Committees have operated regional, and wider-scale, programmes of measurement of ice sheet thickness and bedrock elevation,*

the Working Group recommends that National Committees

recover and collate historic measurements of ice sheet thickness, and contribute these to the coordinated data compilation and bedrock mapping project, BEDMAP, which will update the existing SPRI bedrock data set.

APPENDIX 2. Note of support from Dr David Drewry, co-author of the SPRI Glaciological and Geophysical Folio compilation of Antarctic Ice Sheet Thickness.

Dear David

Thank you for your kind invitation to the BEDMAP meeting. I am sorry to have taken a while to respond - both out of the country and also waiting to see if my diary would allow me to take up your invitation. Alas, this is not to be. I am out of the country on 21st and on 22nd I have an important engagement which has now been confirmed here in Swindon.

I do very much wish you well in the enterprise and still retain an interest in promoting such activity. I would, therefore, be keen to keep in touch with developments in your project as may be possible.
Pass on my encouragement to your group!

Best regards

David

APPENDIX 3. Program of 1st BEDMAP Workshop 21-22/10/96

Carlyle Room, Arundel House Hotel, Cambridge, UK

Monday, October 21st, 1996

Dr David Vaughan	British Antarctic Survey	09:15
Subject:	Welcome and overview of the proposal BEDMAP	
Dr Ian Goodwin	Antarctic CRC	10:00
Subject:	The role of BEDMAP within SCAR GLOCHANT	

Modelling requirements

Dr Richard Hindmarsh	British Antarctic Survey	11:00
Subject:	Incorporating real bed elevation data into ice sheet models	
Dr Philippe Huybrechts	Alfred-Wegener-Institut für	11:25
Subject:	A modeller's specification for an Antarctic bed elevation map	

Experiences

Mr Paul Cooper	British Antarctic Survey	12:00
Subject:	Experiences with compilation of the SPRI folio series	
Mrs Janet Thomson	British Antarctic Survey	12:25
Subject:	Present state of feature mapping in Antarctica & lessons from Antarctic Digital Database	

Thickness data holdings -1

Dr Hans Oerter &Astrid Lambrecht	Alfred-Wegener-Institut	14:00
Subject	Overview of the AWI RES data holdings	
Dr Christopher Doake	British Antarctic Survey	14:25
Subject:	Overview of archival BAS RES data	
Hugh Corr	British Antarctic Survey	14:50
Subject:	Overview of recent BAS RES data holdings	
Dr Ian Allison	Antarctic CRC	15:15
Subject:	Overview of the Australian RES data holdings	

Thickness data holdings - 2

Dr. Charlie Bentley	University of Wisconsin-Madison	16:00
Subject:	Overview of the US RES/Seismic data holdings	
Prof. Manfred Lange	Westf. Wilhelms-Universität Münster	16:25
Subject:	Overview of University of Münster RES data holdings	
Sergei Popov	Polar Marine Geological Research Expedition (PMGRE)	16:50
Subject:	Overview of Russian RES data holdings	

Tuesday, October, 22nd, 1996

Thickness data holdings - 3

Dr Fumihiko Nishio Hokkaido University of Education, Japan		09:00
Subject:	Overview of Japanese RES/Seismic data holdings	
Prof. I Tabacco University of Milano, Italy		09:25
Subject:	Overview of Italian RES/Seismic data holdings	
Dr Per Holmlund Stockholm University, Sweden		09:50
Subject:	Overview of Swedish RES data holdings	

Surface elevation data holdings

Dr Frederique Remy CNRS France		10:35
Subject:	Overview of satellite derived Antarctic digital elevation model	
Dr Jonathon Bamber University of Bristol, UK		11:00
Subject:	Overview of satellite derived Antarctic digital elevation model	
Mr Ashley Johnson British Antarctic Survey		11:25
Subject:	Recent experiences with Antarctic Digital Magnetic Anomaly Map	

Summary & Open discussion

Dr David Vaughan British Antarctic Survey		11:50
Subject:	Summary of resources required and a possible route forward	
Open discussion		

APPENDIX 4. Protocol concerning the use of data within BEDMAP

To foster a sense of cooperation it is important that BEDMAP has a well defined and inclusive data and publication policy that encourages scientific use of the products, but safeguards and offers significant reward to participants.

The following protocols were generally agreed by the participants as providing adequate safeguards for data-collectors, whilst allowing other BEDMAP partners and, eventually, the wider community the opportunity to use BEDMAP data for research purposes. The guidelines adopted would be broadly similar to those adopted by the ADMAP consortium for magnetic anomaly data (ADMAP, 1995).

- At least until the next BEDMAP workshop any data deposited with the BEDMAP data managers would be considered to be for

the sole use of BEDMAP and would not be released to any third party for other purposes.

- All gridded datasets and contour maps produced by BEDMAP will be freely available to all *bone fide* researchers

- Certain restrictions will apply for access to the individual measurements of ice thickness deposited with BEDMAP. For 3 years after collection data are considered to be the sole property of the originators. For the subsequent 3 years the data will be made available for use by other BEDMAP researchers, provided that this transfer is considered as a collaboration between the originator and recipient, and authorship of resulting publications should acknowledge that collaboration.

- For existing datasets the same restrictions will apply but with the date of publication of this report being considered as the beginning of the process.

- A companion paper will be prepared as an accompaniment to the final bed elevation map. This will be published with an authorship reflecting the entire BEDMAP consortium.

- The copyright of the final product of BEDMAP will be vested with SCAR.

APPENDIX 5. Participants at the first Workshop

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APPENDIX 7. List of abbreviations

ADD	Antarctic Digital Database
ADMAP	Antarctic Digital Magnetic Anomaly Map
AUSLIG	Australian Survey and Land Information Group
BAS	British Antarctic Survey
CRC	Cooperative Research Centre
EISMINT	European Ice Sheet Modelling Initiative
GIS	Geographic Information System
GLOCHANT	Global Change in Antarctica
IHO	International Hydrographic Office
NERC	Natural Environment Research Council
NSF	National Science Foundation
SCAR	Scientific Committee on Antarctic Research
SPRI	Scott Polar Research Institute
TUD	Technical University of Denmark

APPENDIX 8. Specification for the supply of data to the BEDMAP databases

Two BEDMAP databases will be in operation during the next year, one at

BAS and the other at the CRC. Data will be accepted at either of the BEDMAP data centres and will be automatically copied to the other. At this stage the data will remain the property of the contributing institute or researcher and they will only be used within the framework of BEDMAP.

After the first BEDMAP workshop the following specification for data and metadata to be submitted to the BEDMAP database has been drawn up by Ian Allison, Hugh Corr, Janet Thomson and David Vaughan. It was decided that only final interpreted versions of the data should be submitted to the databases. Data will be accepted in ASCII format or a number of proprietary formats. Each data file should contain measurements in column format.

RECORD ID	Unique record number referring to measurement of ice thickness (format described in metadata file)
LATITUDE	Latitude of measurement, decimal degrees, +ve North
LONGITUDE	Longitude of measurement, decimal degrees, +ve East
ICE THICKNESS	Calculated ice thickness / m
SURFACE ELEVATION	Calculated surface elevation / m
More Columns	Add more columns as required (Eg. Date, if a single date of acquisition is not applicable)

Each data file should be accompanied by a file of metadata describing the data in the data file.

Meta data Field	Metadata sub-field	Type	Description
BEDMAP ID		TXT	Reference ID assigned by BEDMAP project
Region		TXT	Geographical area
Data type		KW	Keyword (Airborne RES / Ground-based RES / Seismic / Gravity / Borehole)
Mission	Mission ID	TXT	Description of project / mission
	Record Id. Description	TXT	Description of the physical meaning of the RECORD ID used to distinguish each measurement point
	Platform	TXT	Description of platform from which measurements were made
Ice Thickness	Method	KW	Method used to obtain ice thickness (Seismic, RES, Gravity, Borehole)
	Processing	TXT	Description of algorithm used to calculate ice thickness (Including numeric constants)
	Logging	TXT	Description of data logging methods (Media etc.)

	Accuracy	NR	Estimated accuracy of ice thickness measurement / m
Navigation	Method	KW	Keyword (local fix / DR / Astro / Inertial / Doppler / GPS/ < other >)
	Terrain clearance	TXT	Aircraft height about ground / m (Const. pressure, const. terrain clearance, etc.)
	Logging	TXT	Description of navigation logging methods
	Accuracy	NR	Estimated accuracy of navigation / m
	Horizontal fixing	TXT	Map sheet used in fixing etc.
	Datum	TXT	Ellipsoid to which data is fixed
Surface elevation	Method	TXT	Description of instrumentation, algorithms, etc. Orthometric or ellipsoidal
	Logging	TXT	Description of logging methods
	Accuracy	NR	Estimated accuracy of surface elevation measurements / m
Data	Format	KW	Keyword (Track / Point)
	Volume	TXT	Volume of data
	Location of primary data	TXT	Institute and person holding the original data or best contact.
References	Funding agency	TXT	Agency(s) responsible for funding project
	Responsible person	TXT	Details of a currently active researcher who can give further details
	Reference	TXT	References to publications that have discussed this data
	Availability	TXT	Current availability of data and restrictions placed upon it

TXT - free text, KW - Keyword, NR - Number

In addition, to these fields it is desirable that some system parameters are recorded for each measuring system. These might include: bandwidth, sampling rate, antenna gain, etc.

This specification is offered as a guide to contributors. At this stage data will not be rejected simply on the grounds of incorrect formatting or inadequate metadata.

APPENDIX 9. References

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APPENDIX 10. Catalogue of Antarctic ice thickness datasets

Name	*	SPRI-NSF-TUD 1971/72
Locale	*	Victoria Land, East Antarctica
Type of data	*	Airborne RES 60 MHZ
Approx. amount	*	14 flights, 7179 points
State of data	*	Digitised, Published
Dates collected	*	1971-72
Navigation	*	
Data holder	*	D.G. Vaughan, British Antarctic Survey
Contact name	*	D.G. Vaughan, British Antarctic Survey
Country		* UK/USA/Denmark
Funding		* NERC/NSF
Publications	*	SPRI Glaciological & Geophysical Folio Series Sheet 3
Availability	*	

Name	*	SPRI-NSF-TUD 1974/75
Locale	*	Siple Coast, Ross Ice Shelf, East Antarctica
Type of data	*	Airborne RES 60 MHZ
Approx. amount	*	46 flights, 27424 points
State of data	*	Digitised, Published
Dates collected	*	1974-75
Navigation	*	
Data holder	*	D.G. Vaughan, British Antarctic Survey
Contact name	*	D.G. Vaughan, British Antarctic Survey
Country		* UK/USA/Denmark
Funding		* NERC/NSF
Publications	*	SPRI Glaciological & Geophysical Folio Series Sheet 3
Availability	*	

Name	*	SPRI-NSF-TUD 1977/78
Locale	*	Institute Ice Stream, East Antarctica
Type of data	*	Airborne RES 60 MHZ
Approx. amount	*	11 flights, 17591 points
State of data	*	Digitised, Published
Dates collected	*	1977-78
Navigation	*	Various

Data holder	*	D.G. Vaughan, British Antarctic Survey
Contact name	*	D.G. Vaughan, British Antarctic Survey
Country		* UK/USA/Denmark
Funding		* NERC/NSF
Publications	*	SPRI Glaciological & Geophysical Folio Series Sheet 3
Availability	*	

Name	*	SPRI-NSF-TUD 1978/79
Locale	*	Institute Ice Stream, Dufek Massif, Thwaites Glacier
Type of data	*	Airborne RES 60 MHZ
Approx. amount	*	9 flights, 41452 points
State of data	*	Digitised, Published
Dates collected	*	1978-79
Navigation	*	Various
Data holder	*	D.G. Vaughan, British Antarctic Survey
Contact name	*	D.G. Vaughan, British Antarctic Survey
Country	*	UK/USA/Denmark
Funding	*	NERC/NSF
Publications	*	SPRI Glaciological & Geophysical Folio Series Sheet 3
Availability	*	

Name	*	Rutford Seismic Data
Locale	*	Rutford Ice Stream
Type of data	*	Seismic
Approx. amount	*	30 line km + spot sounding
State of data	*	Digital data, mostly published
Dates collected	*	Dec 91-Feb 92, Nov 92-Feb 93
Navigation	*	Optical survey controlled with magnavox geoceiver
Data holder	*	A M Smith
Contact name	*	A M Smith
Country	*	UK
Funding	*	NERC (BAS)
Publications	*	A M Smith & CSM Doake (1994) Annals of Glaciology, V20, p353-356,
	*	Sea bed depths at the mouth of Rutford Ice Stream, Antarctica
	*	A M Smith (In press) JGR. Basal conditions on Rutford Ice Stream,
West	*	Antarctica from seismic observations.
	*	A M Smith (In press) Journal of Glaciology. Variations in basal
conditions		
	*	on Rutford Ice Stream, West Antarctica.
Availability	*	On request

Name	*	BAS 1966/67
Locale	*	Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised, published
Dates collected	*	Dec 66 - Feb 67
Navigation	*	Dead reckoning (air speed) - 5 cm, but tied to map
Data holder	*	BAS
Contact name	*	D G Vaughan
Country	*	UK
Funding	*	NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1969/70
Locale	*	Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised, published
Dates collected	*	Dec 69 - Feb 70
Navigation	*	Dead reckoning (air speed) - 5 km, tied to maps
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1971-/2
Locale	*	Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Dec 71- Feb 72
Navigation	*	Dead reckoning (air speed) - 5km, tied to maps
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1974/75
Locale	*	Ellsworth Land, Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Dec 71- Feb 72
Navigation	*	Dead reckoning (air speed) - 5 km tied to maps
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1974/75
Locale	*	Ellsworth Land, Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan-Feb 75
Navigation	*	INS, dead reckoning (air speed) - 1-5km
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1980/81
Locale	*	Ellsoworth Land, Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan - Feb 1981
Navigation	*	Doppler - 3 km
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1982/83
Locale	*	Ronne Ice Shelf
Type of data	*	RES & Aeromagnetic
Approx. amount	*	
State of data	*	Digistised, published
Dates collected	*	Jan-Feb 1983
Navigation	*	Doppler
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1983/84
Locale	*	Ellsworth Land to Thiel Mountains
Type of data	*	RES and Aeromagnetic
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan-Feb 1984
Navigation	*	Doppler
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1984/85
Locale	*	Ronne Ice Shelf, Antarctic Peninsula
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan - Feb 1985
Navigation	*	Doppler
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1985/86
Locale	*	Antarctic Peninsula
Type of data	*	RES & Aeromagnetic
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan-Feb 1986
Navigation	*	Doppler - 3km
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS 1987/88
Locale	*	Ronne Ice Shelf
Type of data	*	RES
Approx. amount	*	
State of data	*	Digitised
Dates collected	*	Jan-Feb 1988
Navigation	*	Doppler + GPS - 3km
Data holder	*	BAS
Contact name	*	D G Vaughan
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS Seismics 94/95
Locale	*	George IV Sound between Uranus Glacier and Batterbee Mountains
Type of data	*	Seismic reflection records
Approx. amount	*	28 km
State of data	*	Data currently being processes
Dates collected	*	Dec 1994 - Jan 1995
Navigation	*	GPS, differentially corrected - 5m
Data holder	*	BAS
Contact name	*	E C King
Country		* UK
Funding		* NERC
Publications	*	
Availability	*	On request

Name	*	BAS Seismics 1988/89
Locale	*	Larsen Ice Shelf 25km E of Francis Island
Type of data	*	Seismic reflection lines
Approx. amount	*	25 km
State of data	*	Published as reflection record but seabed depths not digitised
Dates collected	*	January 1989
Navigation	*	GPS ± 100m
Data holder	*	BAS
Contact name	*	E C King
Country		* UK
Funding		* NERC
Publications	*	Jarvis & King Antarctic Science V7, 1995, 181-190
Availability	*	On request

Name	*	BAS Seismics 1991-1993
Locale	*	Ronne Ice Shelf in the region of 75E30'S 60E0'W
Type of data	*	Seismic Reflection Records
Approx. amount	*	158km
State of data	*	Seismic reflection records published but seabed depths not digitised
Dates collected	*	Dec 91-Feb 92, Jan 93-Feb 93
Navigation	*	GPS, handheld receiver, SA on, no differential - 50-80m
Data holder	*	BAS
Contact name	*	E C King
Country		* UK
Funding		* NERC
Publications	*	New seismic data from Ronne Ice Shelf EC King & A C Bell 1996
	*	Geol Soc. Special Publication 108, pp 213-226
Availability	*	On request

Name	*	Japanese East Queen Maud Land data
Locale	*	East Queen Maud Land (15EE - 55EE/68E - 80ES)
Type of data	*	Airborne RES
Approx. amount	*	50 000 point data
State of data	*	Digitised data, folio map series (hard copy maps)
Dates collected	*	
Navigation	*	Astronmical positioning (1969, NNSS (1980/4 1-2km), GPS (1985 .100m)
Data holder	*	Natl Inst of Polar Res
Contact name	*	Fumihiko NISHIO
Country		* Japan
Funding		* Natl Inst of Polar Res
Publications	*	Folio map
Availability	*	On request

Name	*	EPICA DML1
Locale	*	Western Dronning Maud Land 71ES-76ES, 100EW - 20EE
Type of data	*	Airborne radio echo sounding
Approx. amount	*	
State of data	*	Digital data, unpublished
Dates collected	*	Jan-Feb 1996
Navigation	*	± 100m x,y ± 50mz (Barometric height)
Data holder	*	AWI
Contact name	*	Uwe Nixdorf/Hans Oerter
Country		* Germany
Funding		* AWI
Publications	*	No
Availability	*	Restricted, with permission of owner

Name	*	
Locale	*	Enderby Land
Type of data	*	Refl seismic
Approx. amount	*	185 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1970/71 and 1974/75
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country		* Russia
Funding		*
Publications	*	No publications
Availability	*	after publication

Name	*	
Locale	*	Mac-Robertson Land, Princess Elisabeth Land
Type of data	*	AMS Middle range Iliyushin aircraft
Approx. amount	*	428.2 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1971-74
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	after publication

Name	*	
Locale	*	Mac-Robertson Land, Princess Elisabeth Land
Type of data	*	Refl. Seismic
Approx. amount	*	247 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1971/74
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Coats Lalnd, Ronne Filchner Ice Shelf
Type of data	*	AMS Middle range Iliyushin aircraft
Approx. amount	*	583 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1980/81
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Ronne Filchner Ice Shelf
Type of data	*	AMS Middle range Iliyushin aircraft
Approx. amount	*	315 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1980/81
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Pensacola mountains
Type of data	*	AGMS Middle range Iliyushin aircraft
Approx. amount	*	130 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1981/82
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Ellsworth Land
Type of data	*	AMS middle range Iliyushin aircraft
Approx. amount	*	60 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1984/85
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Palmer Land
Type of data	*	RES land survey
Approx. amount	*	0.63 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1985/86
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Prince Charles Mountains region
Type of data	*	AMS Middle range Iliyushin aircraft
Approx. amount	*	17.2 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1985/86
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Enderby Land
Type of data	*	AGMS middle range Iliyushin aircraft
Approx. amount	*	160 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1985/86
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country		* Russia
Funding		*
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Princess Elisabeth Land
Type of data	*	AMS middle range Iliyushin aircraft
Approx. amount	*	20 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1986/87
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country		* Russia
Funding		*
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Princess Martha Coast
Type of data	*	AGMS middle range Iliyushin aircraft
Approx. amount	*	130 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1986/87
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country		* Russia
Funding		*
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Prince Charles Mountains
Type of data	*	AMS middle range Iliyushin aircraft
Approx. amount	*	57.2 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1987/88
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country		* Russia
Funding		*
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Jamato Mountains
Type of data	*	AGMS middle range Iliyushin aircraft
Approx. amount	*	160 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1987/88
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Enderby Land
Type of data	*	AGMS middle range Iliyushin aircraft
Approx. amount	*	600 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1988/89
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Dronning Maud Land
Type of data	*	AMS middle range Iliyushin aircraft
Approx. amount	*	97.6 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1988/89
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Coats Land
Type of data	*	AGMS middle range Iliyushin aircraft
Approx. amount	*	230 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1988/89
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Dronning Maud Land
Type of data	*	AGMS Long range Illiyushin aircraft
Approx. amount	*	839 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1988/89
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Mac-Robertson Land
Type of data	*	AMS middle range Illiyushin aircraft
Approx. amount	*	65 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1989/90
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Enderby Land
Type of data	*	AGMS long range Iliyushin aircraft
Approx. amount	*	710 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1989/90
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Princess Elisabeth Land
Type of data	*	AMS middle range Iliyushin aircraft
Approx. amount	*	38.5 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1990/91
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Dronning Maud Land
Type of data	*	AGMS long range Illiyushin aircraft
Approx. amount	*	120 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1990/91
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Mac-Robertson Land
Type of data	*	AMS short range Antonov aircraft
Approx. amount	*	24.4 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1994
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Mac-Robertson Land
Type of data	*	AMS short range Antonov aircraft
Approx. amount	*	24.4 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1994
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	
Locale	*	Mac-Robertson Land
Type of data	*	AMS short range Antonov aircraft
Approx. amount	*	5.4 sq km
State of data	*	All data digitised, ASCII and Paradox
Dates collected	*	1995
Navigation	*	GPS Astronomy, Doppler system, photonavig, from 70-80M to 2-5000M
Data holder	*	PMGRE
Contact name	*	S Popov, Dr V Masolov, ice@ polarex.spb.ru
Country	*	Russia
Funding	*	
Publications	*	No publications
Availability	*	After publication

Name	*	Italian BBD Rock/Dome C & Northern Victoria Land
Locale	*	74.5-72E S - 165-170EE
Type of data	*	Ice thickness/surface elevation
Approx. amount	*	- 20 000 data points
State of data	*	Digitised data, in progress
Dates collected	*	1995/96
Navigation	*	GPS 1-5m
Data holder	*	PNRA (Univ Milan)
Contact name	*	I Tabacco
Country		* Italy
Funding		* PNRA
Publications	*	In progress (Technical Report)
Availability	*	Yes

Name	*	AWI EMR 95 DAT
Locale	*	Ronne Ice Shelf
Type of data	*	Airborne radio echo sounding
Approx. amount	*	9440 km
State of data	*	Digital along flight llines, unpublished, submitted for FRISP report
Dates collected	*	January 1995
Navigation	*	GPS, single point solution, ±100m x,y, ± 50m elevation (barometric height)
Data holder	*	AWI
Contact name	*	Uwe Nixdorf
Country		* Germany
Funding		* AWI
Publications	*	No
Availability	*	Restricted by permission of owner

Name	*	MAGRAD 94
Locale	*	Brunt Ice Shelf - Western Dronning Maud Land, 76-80ES, 25-10EW
Type of data	*	Airborne radio echo sounding
Approx. amount	*	- 12000 km
State of data	*	Unprocessed
Dates collected	*	December 1994
Navigation	*	GPS single point solution, ±100m x,y ± 50mz (barometric height)
Data holder	*	AWI
Contact name	*	Uwi Nixdorf/Alfous Eckstaller
Country		* Germany
Funding		* AWI
Publications	*	No
Availability	*	No

Name	*	Little America Byrd Traverse
Locale	*	Little America Station (Ross Ice Shelf) to Byrd Station (Central W Ant)
Type of data	*	Seismic and gravity soundings; barometric altimetry
Approx. amount	*	13 seismic soundings, 130 gravity soundings, 130 elev measu
State of data	*	Published
Dates collected	*	Feb 1957
Navigation	*	Marked trail, O.5 km
Data holder	*	U Wisconsin
Contact name	*	C R Bentley
Country		* USA
Funding		* NSF
Publications	*	Bentley,CR and NA Ostenso, Glacial and subglacial topography of
West	*	Antarctica *J Glaciol* 3, 882-911, 1960.
Availability	*	Full

Name	*	Ross Ice Shelf Traverse
Locale	*	Ross Ice Shelf
Type of data	*	Seis, gravity, altimetry
Approx. amount	*	46 seismic, 204 gravity, 328 alt
State of data	*	Published
Dates collected	*	Nov 1957 - Feb 1958
Navigation	*	Sun shots - 0.5 km
Data holder	*	U Wisc
Contact name	*	C Bentley
Country		* USA
Funding		* NSF
Publications	*	Crary, Results of US traverses in East Antarctica, 1958-61, IGY Glac Rept
	*	Series 7, AGS, 1962
Availability	*	Full

Name	*	Sentinel Traverse
Locale	*	Byrd Sta - Mt Takake - Sentinel Mtn - Byrd Stn (Central W Ant)
Type of data	*	Seis, grav, alt
Approx. amount	*	35 seismic, 365 grav, 365 alt
State of data	*	Published
Dates collected	*	Nov 57 to Feb 58
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	C R Bentley
Country		* USA
Funding		* NSF
Publications	*	Bentley,CR and NA Ostenso, Glacial and subglacial topography of West
	*	Antarctica *J Glaciol* 3, 882-911, 1960.
Availability	*	Full

Name	*	Filchner Ice Shelf Traverse
Locale	*	Ellsworth Stn to Southern Ronne Ice Shelf
Type of data	*	Seis, grav, altimeter
Approx. amount	*	27 seis, 224 grav, 224 alt
State of data	*	Tabulated
Dates collected	*	Nov 57 to Feb 58
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	
Availability	*	Full

Name	*	McMurdo-Victoria Land Traverse
Locale	*	McMurdo Station - 132^0
Type of data	*	Seis, grav, alt
Approx. amount	*	50 seis, 253 grav, 2100 alt
State of data	*	Published
Dates collected	*	1958-59
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	Crary, Results of US traverses in East Antarctica, 1958-61, IGY Glac Rept
	*	Series 7, AGS, 1962
Availability	*	Full

Name	*	Horlick Traverse
Locale	*	Byrd Stn - Horlick Mtn - Byrd
Type of data	*	Seis, grav, alt
Approx. amount	*	32 seis, 283 grav, 328 alt
State of data	*	Published, tabulated
Dates collected	*	1958-59
Navigation	*	Sun shot, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Bentley,CR and NA Ostenso, Glacial and subglacial topography of West
	*	Antarctica *J Glaciol* 3, 882-911, 1960.
Availability	*	Full

Name	*	Ellsworth Byrd Traverse
Locale	*	Ellsworth Stn - Byrd Stn (Filchner I S - Central W Ant)
Type of data	*	Seis, alt
Approx. amount	*	14 seis, 19 alt
State of data	*	Tabulated
Dates collected	*	1958-59
Navigation	*	Sun shot, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Full

Name	*	1958-59 Airlifted Traverse
Locale	*	132^{0}W longitude
Type of data	*	Seis, grav, alt
Approx. amount	*	7 stations
State of data	*	Published
Dates collected	*	1958-59
Navigation	*	Aircraft sun shot or DR 5 Km (nominal)
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Thiel,EC., Antarctica, one continent or two?., Polar Record, 10, 335-348, 1962
Availability	*	Full

Name	*	1959-60 Airlifted traverse
Locale	*	88^{0}W longitude
Type of data	*	Seis, grav, alt
Approx. amount	*	4 stations
State of data	*	Published
Dates collected	*	1959-60
Navigation	*	Aircraft sunshots or DR 5km (nominal)
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Thiel,EC., Antarctica, one continent or two?., Polar Record, 10, 335-348, 1962
Availability	*	Full

Name	*	Victorial Land Traverse
Locale	*	McMurdo-Skelton Gl-Victoria Land-Rennick Gl
Type of data	*	Seis, grav, alt
Approx. amount	*	17 seis, 391 grav, 391 alt
State of data	*	Published
Dates collected	*	1959-60
Navigation	*	Sun shot, 0.5km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Crary, Results of US traverses in East Antarctica, 1958-61, IGY Glac Rept
	*	Series 7, AGS, 1962
Availability	*	Full

Name	*	Marie Byrd Land Traverse
Locale	*	Loop Byrd Stn - Executive Comm Range - Getz Ice Shelf - Byrd
Type of data	*	Seis, grav, alt
Approx. amount	*	27 seis, 356 grav, 356 alt
State of data	*	Tabulated
Dates collected	*	1959-60
Navigation	*	Sun shot, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Bentley & Chang Ant Rsch Ser 16 1971
Availability	*	Full

Name	*	Discovery Deep Traverse
Locale	*	McMurdo Discovery Deep (Ross Is)
Type of data	*	Seis, grav, alt
Approx. amount	*	4 seis, 80 grav, 80 alt
State of data	*	Published
Dates collected	*	1960
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Crary, AP, ES Robinson, HF Bennett and WW Boyd Jr, Glacial studies of
	*	the Ross Ice Shelf, Antarctica, IGY Glaciology Rept Series 6, Amer.Geogr.
	*	Soc., 1962
Availability	*	Full

Name	*	McMurdo-Pole Traverse
Locale	*	McMurdo Station Gl - South Pole
Type of data	*	Seis, grav, alt
Approx. amount	*	14 seis, 284 grav, 4300 alt
State of data	*	Tabulated
Dates collected	*	1960-61
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Robinson, Ant Resch Ser C 1980
Availability	*	Full

Name	*	Ellsworth Highland Traverse
Locale	*	Byrd Station - Jones Mtn
Type of data	*	Seis, grav, alt
Approx. amount	*	50 seis, 405 grav, 3000 alt
State of data	*	Tabulated
Dates collected	*	1960-61
Navigation	*	Sun shots, 0.5km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Full

Name	*	1960-61 Airlifted traverse
Locale	*	Walgreen Coast
Type of data	*	Seis, grav, alt
Approx. amount	*	5 Stations
State of data	*	Published
Dates collected	*	1960-61
Navigation	*	Aircraft sunshots DR
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Behrendt,JC, TS Laudon, RJ Wold. Resultsl of a geophysical and
	*	geological traverse from Mt Murphy to the Hudson Mts, Antarctica.
JGR	*	67 3973-80, 1962
Availability	*	Full

Name	*	Ellsworth Land Traverse
Locale	*	Jones Mts to base of Ant Pen
Type of data	*	Seis, grav, alt
Approx. amount	*	43 Seis, 250 grav, 2000 alt
State of data	*	Tabulated
Dates collected	*	1961-2
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	U Wisc, GPRC Rsch Report 64-1
Availability	*	Full

Name	*	Roosevelt Island Survey
Locale	*	Roosevelt I (RIS)
Type of data	*	Seis, grav, alt
Approx. amount	*	70 seis, 320 grav, 320 alt
State of data	*	Tabulated
Dates collected	*	1962-3
Navigation	*	Sun shots
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Full

Name	*	Wisconsin Traverse
Locale	*	Bund Sta - base of FRIS - Byrd
Type of data	*	Seis, grav, alt
Approx. amount	*	45 seis, 515 grav, 515 alt
State of data	*	Tabulated
Dates collected	*	1963-64
Navigation	*	Sun shots, 0.5km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Full

Name	*	South Pole Traverse
Locale	*	2 loops, South Pole to Transant Mts
Type of data	*	Seis, grav, alt
Approx. amount	*	-30 seis, -200 grav and alt
State of data	*	Published (?)
Dates collected	*	1961-2
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Robinson, Ant Resch Ser, - 1980
Availability	*	Avail in principle, needs to be checked

Name	*	South Pole - Queen Maud Land Traverse I of II
Locale	*	South Pole - Pole of Inacces - Plateau Sta
Type of data	*	Seis, grav, alt, radar (SPQMLI II only)
Approx. amount	*	- 50 seis, -300 grav and alt, - 500 radar
State of data	*	Published
Dates collected	*	1964-66
Navigation	*	Sun shots, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Beitzel, 1971
Availability	*	Full

Name	*	South Pole - Queen Maud Land Traverse III
Locale	*	Plateau Sta - 78E42'S, 6E52'W
Type of data	*	Seis, grav, alt, radar
Approx. amount	*	-20 seis, -170 grav, -200 km radar profiling
State of data	*	Published
Dates collected	*	1967-68
Navigation	*	Sun shots 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	Clough et al, 1968
Availability	*	Full in principle

Name	*	Ross Ice Shelf (Geophysical Glaciological Survey (RIGGGS)
Locale	*	Ross Ice Shelf
Type of data	*	Seis, grav, radar flights
Approx. amount	*	- 200 seis and grav, -5000 km flight lines
State of data	*	Published tabulated results; radar data on polaroid film
Dates collected	*	1973-78
Navigation	*	Mostly transit satellite receiver, -10m
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	Greischear et all., 1992, Bentley 1984
Availability	*	Full

Name	*	Geophysical Survey of Interior Ross Embayment (GSIRE)
Locale	*	Ice Streams A, B, and C and intervening ridges
Type of data	*	Airborne radar
Approx. amount	*	- 3000 km
State of data	*	Results published; data on Polaroid film
Dates collected	*	1983-1986
Navigation	*	INS, 1 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	Shablaie & Bentley, 1987
Availability	*	Full

Name	*	Siple Coast Project
Locale	*	Inland ice streams B and C and ridges ABMBC
Type of data	*	Radar flight
Approx. amount	*	- 4000 km
State of data	*	Results, published; data on digitial tape
Dates collected	*	1988-89
Navigation	*	INS, with some GPS - controlled surface tie points, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	Retzlaff et al, 1993
Availability	*	Full

Name	*	Siple Coast Project
Locale	*	Downstream end of ice streams B & C
Type of data	*	Radar flights
Approx. amount	*	- Radar flights
State of data	*	Map of ice thicknesses submitted for publ; data on digital tape
Dates collected	*	1987-88
Navigation	*	INS, some ground control, 0.5 km
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country		* USA
Funding		* NSF
Publications	*	Bentley et al, Ant J US, submitted
Availability	*	Full

Name	*	Taylor Dome Survey
Locale	*	Taylor Dome
Type of data	*	RES/laser alt flights
Approx. amount	*	3000 km
State of data	*	In analysis
Dates collected	*	1991-92
Navigation	*	?
Data holder	*	U Texas at Austin
Contact name	*	D Blankenship
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Uncertain, check with contact

Name	*	LASERTZ
Locale	*	Central west Antarctica
Type of data	*	Radar/laser alt flights
Approx. amount	*	- 50,000
State of data	*	In analysis
Dates collected	*	1991-93
Navigation	*	GPS and high precision ranging, 10m
Data holder	*	U Texas at Austin
Contact name	*	D Blankenship
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Uncertain check with contact

Name	*	West Antarctic Glaciology
Locale	*	Trunk of ice streams D of E
Type of data	*	RES/laser alt flights
Approx. amount	*	5000 km
State of data	*	In analysis
Dates collected	*	1992-93
Navigation	*	GPS 10m
Data holder	*	U Texas at Austin
Contact name	*	D Blankenship
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Uncertain check with contact

Name	*	Ice Stream D
Locale	*	Ice stream D
Type of data	*	Radar flights
Approx. amount	*	- 2000 km
State of data	*	DAT tape, just collected
Dates collected	*	1995-96
Navigation	*	GPS 10m
Data holder	*	U Wisconsin
Contact name	*	CR Bentley
Country	*	USA
Funding	*	NSF
Publications	*	None
Availability	*	2 years after survey completed in 1996-97

Name	*	CASERTZ
Locale	*	Central West Antarctica
Type of data	*	RES/laser alt
Approx. amount	*	106,000 km
State of data	*	In analysis
Dates collected	*	1994-97
Navigation	*	GPS 10m
Data holder	*	U Texas at Austin
Contact name	*	D Blankenship
Country	*	USA
Funding	*	NSF
Publications	*	-
Availability	*	Uncertain, check with contact

Name	*	Antarctic surface DEM
Locale	*	Antarctica continental
Type of data	*	ERS-1, elevation (supplement by ADD)
Approx. amount	*	1121x1121 grid at 5km x 3
State of data	*	Completed, in press
Dates collected	*	-
Navigation	*	-
Data holder	*	J Bamber
Contact name	*	as abpve
Country	*	UK
Funding	*	HEFCE
Publications	*	Annals 25/23
Availability	*	Through collaboration

Name	*	ERS-1 surface elevation
Locale	*	Antarctica continental
Type of data	*	ERS altimeter data
Approx. amount	*	
State of data	*	Digitised 10 km x 10 km or any enlargement anywhere without problem
Dates collected	*	
Navigation	*	
Data holder	*	Remy
Contact name	*	
Country	*	France
Funding	*	CNRS
Publications	*	Brussels and Remy, Annals of Glaciol 23
Availability	*	Yes

Name	*	BAS Rutford Ice Stream
Locale	*	Rutford Ice Stream
Type of data	*	Ground based RES
Approx. amount	*	200 points
State of data	*	Processed
Dates collected	*	1987/88
Navigation	*	Survey, 10m
Data holder	*	BAS
Contact name	*	RM Frolich
Country	*	UK
Funding	*	NERC
Publications	*	
Availability	*	Request

Name	*	Belgian 1969
Locale	*	Jelbarbisen - Trolltunga
Type of data	*	Ground based RES
Approx. amount	*	
State of data	*	Published maps (original data not known)
Dates collected	*	
Navigation	*	
Data holder	*	H Decleir-Essene
Contact name	*	
Country	*	Belgium
Funding	*	
Publications	*	T van Antenboer & H Decleir Data Report 1969 Belgium Antarctic Exp.
	*	Processional paper 1975 No 1
Availability	*	Not known

Name	*	Belgian - Sen Rondane
Locale	*	Sen Rondane
Type of data	*	RES and gravity
Approx. amount	*	
State of data	*	Published (original data in unknown condition)
Dates collected	*	
Navigation	*	
Data holder	*	H Decleir
Contact name	*	
Country	*	Belgium and Japan
Funding	*	
Publications	*	Decleir, Nishio, Ohmac. Proceedings of NIDR Symposium in Polar Met &
	*	Glac No 2
Availability	*	Unknown

Name	*	Munster - Berkner Is
Locale	*	Berkner Is
Type of data	*	Digital, published
Approx. amount	*	
State of data	*	
Dates collected	*	
Navigation	*	GPS
Data holder	*	
Contact name	*	H Sandhager
Country	*	Germany
Funding	*	-
Publications	*	Thyssen, Sandhager, Bombosch, Polarforschung -
Availability	*	Request

Name	*	Munster - Neuschwabenland
Locale	*	Neuschwabenland
Type of data	*	Airborne RES
Approx. amount	*	
State of data	*	Published
Dates collected	*	1985/86
Navigation	*	
Data holder	*	
Contact name	*	Prof M Lange
Country	*	Germany
Funding	*	
Publications	*	
Availability	*	

Name	*	Munster - Neuschwabenland
Locale	*	Neuschwabenland
Type of data	*	Airborne RES
Approx. amount	*	
State of data	*	Digital
Dates collected	*	1988/89
Navigation	*	
Data holder	*	Prof M Lange
Contact name	*	
Country	*	Germany
Funding	*	
Publications	*	
Availability	*	

Name	*	Swedish Maudheimvidda
Locale	*	Maudheimvidda
Type of data	*	Airborne RES
Approx. amount	*	
State of data	*	Digital
Dates collected	*	
Navigation	*	
Data holder	*	Jean-Ove Näsund
Contact name	*	
Country	*	Sweden
Funding	*	
Publications	*	
Availability	*	

Name	*	AUS001
Locale	*	Enderby and Kemp Lands
Type of data	*	Aerial RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	1976/77 and 1979/80
Navigation	*	Dead reckoning, 1km or better
Data holder	*	Antarctic CRC
Contact name	*	Dr I Allison
Country	*	Australia
Funding	*	
Publications	*	Allison I, Frew R, and Knight I (1979) Surface elevation, ice thickness and
	*	bedrock elevation of the region between Mawson and Amundsen Bay. J.
	*	Geol Soc. Australia 26(5 and 6), 274
Availability	*	

Name	*	AUS002
Locale	*	Enderby Land to Mawson
Type of data	*	Ground based RES
Approx. amount	*	Geocoded digital data set
State of data	*	
Dates collected	*	1975/76
Navigation	*	Route marked by canes, satellite doppler, 0.1-0.3 km
Data holder	*	Antarctic CRC
Contact name	*	Vin Morgan
Country		* Australia
Funding		*
Publications	*	Morgan VI,TH Jacka (1981) Mass Balance studies in East Antarctica. In: I
	*	Allison (Ed) Sea Level, Ice & Climatic Change. IAHS Pub 131 pp 253-60
	*	Morgan, VI,TH Jacka, GJ Akerman, AL Clarke (1982). Outlet glacier and
	*	mass-budget studies in Enderby, Kemp andMacrobertson Land. Ann.
Glac.	*	3 204-210.
Availability	*	

Name	*	AUS003
Locale	*	Amery Ice Shelf
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	1968 and 1970/71
Navigation	*	Marked reference points, 100m
Data holder	*	Antarctic CRC
Contact name	*	Neal Young
Country		* Australia
Funding		*
Publications	*	Budd WF,MJ Corry, TH Jacka. 1982. Results from Amery Ice shelf Project,
	*	Ann Glac. 3 pp 36-41.
Availability	*	

Name	*	AUS004
Locale	*	Lambert Glacier/Amery Ice Shelf
Type of data	*	Aerial RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	Dec 1989
Navigation	*	GPS/dead reckoning, 0.1km to several km for DR
Data holder	*	Antarctic CRC
Contact name	*	I Allison
Country		* Australia
Funding		*
Publications	*	
Availability	*	

Name	*	AUS005
Locale	*	Lambert Glacier/Amery Ice Shelf
Type of data	*	Aerial RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	December 1989
Navigation	*	GPS, 0.1 km
Data holder	*	Antarctic CRC
Contact name	*	I Allison
Country		* Australia
Funding		*
Publications	*	
Availability	*	

Name	*	AUS006
Locale	*	Southern Prince Charles Mountains/Lambert Glacier
Type of data	*	Aerial RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	1972/73 and 1973/74 summer season
Navigation	*	Dead reckoning, 1-2 km
Data holder	*	Antarctic CRC
Contact name	*	Vin Morgan
Country		* Australia
Funding		*
Publications	*	Morgan, VI, WF Budd, 1975. Radio echo sounding of Lambert Glacier
	*	Basin. J.Glac. 15(73) 103-111
Availability	*	

Name	*	AUS007
Locale	*	Lambert Glacier Basin
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	1989/90 to 1994/95
Navigation	*	GPS, 0.1 km
Data holder	*	Antarctic CRC
Contact name	*	I Allison, Andy Brocklesby, Mike Craven
Country		* Australia
Funding		*
Publications	*	Goodwin,I, M Higham,I Allisosn,R Jiawen. 1994. Accumulation variation
	*	in Eastern Kemp Land, Antarctica. Ann Glaciol 20 202-6.
	*	Higham,M, M Reynolds, A Brocklesby, I Allison (1995) Ice radar digital
	*	recording, data processing and results from the Lambert Glacier Basin
	*	Traverses. Terra Antarctica 2(1) 23-32.
Availability	*	

Name	*	AUS008
Locale	*	Wilkes Land - Mirny Pionerskaya-Dome C route
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	
Dates collected	*	1978-86
Navigation	*	Transit doppler satellite, 0.5 km
Data holder	*	Antarctic CRC
Contact name	*	Neal Young
Country		* Australia
Funding		*
Publications	*	Young, NW 1979 Measured velocities of interior E Antarctica and state of
	*	mass balance within IAGP area. J. Glac. 24(90):77-87
Availability	*	

Name	*	AUS009
Locale	*	Wilkes Land - western route
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	
Dates collected	*	1978 to 1986
Navigation	*	
Data holder	*	Antarctic CRC
Contact name	*	Neal Young
Country		* Australia
Funding		*
Publications	*	Young,NW, I Goodwin,NWJ Hazelton, RJ Thwaites, 1989. Measured
	*	velocities and ice flow in Wilkes Land, Antarctica Ann. Glac. 12: 192-7.
Availability	*	

Name	*	AUS010
Locale	*	Wilkes Land - southern route
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	
Dates collected	*	1978-86
Navigation	*	Transit doppler satellite, 0.5km
Data holder	*	Antarctic CRC
Contact name	*	Neal Young
Country		* Australia
Funding		*
Publications	*	
Availability	*	

Name	*	AUS011
Locale	*	Wilkes Land - eastern route
Type of data	*	Surface RES
Approx. amount	*	
State of data	*	
Dates collected	*	1978-86
Navigation	*	Transit doppler satellite, 0.5 km
Data holder	*	Antarctic CRC
Contact name	*	Neal Young
Country		* Australia
Funding		*
Publications	*	Young,NW, ID Goodwin,NWJ Hazelton, RJ Thwaites. 1989. Measured
	*	velocities and ice flow in Wilkes Land, Antarctica. Ann. Glac. 12 192-7.
Availability	*	

Name	*	AUS012
Locale	*	Law Dome Summit
Type of data	*	Ground based RES
Approx. amount	*	
State of data	*	Geocoded digital data set
Dates collected	*	
Navigation	*	Cane marked route, 200m
Data holder	*	Antarctic CRC
Contact name	*	Vin Moran
Country		* Australia
Funding		*
Publications	*	Morgan,VI, CW Wookey.Li J van Ommen, TD Skinner, MF Fitzpatrick.
	*	Site information and initial results from deep ice drilling on Law Dome. J
	*	Glaciol in press
	*	Hamley,TC, VI Morgan,RJ Thwaites,XQ Gao. 1986. An ice core drilling
	*	site at Law Dome summit, Wilkes Land, Antarctic. ANARE Res. Notes. 34,
Availability	*	

Name	*	AUS013
Locale	*	Vanderford Glacier
Type of data	*	Airborne RES
Approx. amount	*	
State of data	*	
Dates collected	*	1984/85
Navigation	*	radio navigation. 10m
Data holder	*	Antarctic CRC
Contact name	*	Vin Morgan
Country		* Australia
Funding		*
Publications	*	Davis,ER, DJ Jones, VI Morgan,NW Young 1986. A survey of the
	*	Vanderford and Adams Glaciers in East Antarctica. Ann Glac 8: 197.
Availability	*	