

**Proposal for the preparation of a new
International Bathymetric Chart of the Southern Ocean
(IBCSO)**

**to be presented at the
XXVII SCAR Meeting of the WG on Geodesy and Geographic Information
in Shanghai, in July 2002**

The topography of the Southern Ocean, defined in the IHO S-23 Document as the area south of 60°S surrounding Antarctica, is still widely unknown. This ocean presently contains, due to continuous ice-coverage, so-called “white spots”, which describes areas without any knowledge about form and structure of the seafloor. However, the survey activities of modern ice-breaking research vessels during the last decade using multibeam systems have increased the data-base, which may result in compilations of new bathymetric charts around Antarctica that could reveal the seafloor morphology of large “white spots”.

However, most of the collected single beam and multibeam sonar data are not archived or inventoried and only limited metadata information about expeditions or surveys is available.

Assembling a bathymetric database including the important metadata, such as information about used navigational and sounding system, present many challenges. Still today most of the collected single beam and multibeam sonar data are not properly archived or inventoried, and the crucial metadata information may be far from readily available. We believe that the most complete bathymetric database of the Southern Ocean only can be assembled through an international project with the focus on gathering all the available bathymetric data including the important metadata with participants from all nations that carries out research around Antarctica.

Bathymetric data play an important role in climate, environmental and solid earth research, especially for:

- geo-referencing and interpreting of bio-geo-marine observations
- studying marine glacial and sedimentation processes
- supplying DEMs for ocean circulation modelling
- studying of physiography and tectonics
- making reliable Nautical Charts for the safety of navigation.

Until today a systematic compilation of bathymetric charts has only been performed in the Atlantic sector of Antarctica, in the region of the Weddell Sea (Schenke et. al, 1998). An expansion of the working area to 60° S was finished last year. The 9 sheets compiled at a scale of 1:1 Mio. are organized following the GEBCO and IBC regulation (Fig. 1). For the determination of the contours and the generation of the charts, the Geographic Information systems CARIS and ArcInfo were utilised. The underlying raw bathymetric data are, up to now, not archived in any data-base.

During the last GEBCO-Meeting in Durham, NH, USA in May 2002, Ron Macnab (GSC, Retired) and Martin Jakobsson (CCOM/JHC) tabled a discussion paper about assembling a new comprehensive bathymetric data-base of the Southern Ocean that will serve as a base for a compilations of a new bathymetric chart. Recognizing the international success and worldwide acceptance of the IBCAO and its scientific benefit, a proposal for a new International Bathymetric Chart of the Southern Ocean (IBCSO) was discussed. On 20 May 2002 a short information meeting

of an ad-hoc working group was held. The ad-hoc group established an interim Editorial Board comprising:

Hans Werner Schenke, AWI, Germany

Robin Falconer, Institute of Geological and Nuclear Sciences, New Zealand

Neil Guy, Director, IHB Monaco

Martin Jakobsson, CCOM/JHC, USA/Sweden

Ron Macnab, GSC (retired), Canada

David Divins, NGDC, Boulder, CO

Norman Cherkis, Alexandria, USA

Work plan

In wide areas around Antarctica, bathymetric data is of low quality and very heterogeneous due to the inherent problems with navigation and sonar measurements in the sea ice. This implies similar problems for bathymetric compilations as were encountered during the IBCAO project (Macnab and Jakobsson, 2000). However, in areas of sparse sonar data, free air gravity anomalies derived from satellite radar altimetry, for example the products from the ERS-Missions, which cover most of the Southern Ocean, can be used to aid morphological interpolation of the seafloor topography. The future CRYOSAT-Mission may also supply improved gravity models over ice covered areas around Antarctica due to its new measurement technique over ice. Therefore, sophisticated methods as developed by Smith and Sandwell (1997) for interpolation and modelling of bathymetric grids in sparse data regions using gravity anomaly models have a large potential for the Southern Ocean compilation. The work plan for the proposed IBCSO may be summarized with the following steps:

1. Building and maintaining of a thorough data base, comprising
 - all existing single beam, multibeam and interferometric sidescan sonar depth data,
 - its meta information
 - existing digital bathymetric charts
 - existing marine gravity data, and
 - free-air gravity models from satellite radar altimetry
2. Quality control and assessment, analysis and editing of available bathymetric data
3. Development of a new method for morphological interpolation of bathymetric contours using sonar data and satellite radar altimetry gravity anomalies
4. Determination of Digital Terrain Models around Antarctica. One with a resolution of 2.5 x 2.5 km on a Southern Polar Stereographic projection for minimal distortion due to the southerly latitude and one geographic grid with a resolution of 1'x1' that easily can be merged with other global ocean topography products.
5. Creation of a set of 1:1 Million traditional bathymetry sheets to be distributed in digital form.

We propose to store and maintain the bathymetric data in an ORACLE database. This has the advantage of that the data can be stored in a way so it can be accessed from several of today's leading GIS system including ArcInfo from ESRI, Geomedia from Intergraph, and MapInfo.

The IBCSO shall be developed under the auspices and umbrella of the intergovernmental and international organisation IOC, IHO, and SCAR. These organisations should be contacted in order to set up the IBCSO into an official frame:

1. IOC Consultative Group on Ocean Mapping (Chair: Guenter Giermann)
Worldwide seven Regional International Bathymetric Charts (IBC) are presently implemented under the supervision of IOC CGOM (IBCM, IBCAO, IBCWIO, IBCCA, IBCSWP, IBCEA, IBCSEP). First information about a new IBCSO was given during the last IOC Executive Council Meeting in Paris, June 4-14, 2002.
2. IHO Antarctic Hydrographic Commission (Chairman: Radm Neil Guy)
The chairman of this commission has expressed the high interest of the IHO Member states which are involved in the realisation of the new Nautical INT Chart scheme around Antarctica. The availability and utilisation of bathymetric information is of high importance for the creation of up-to-date Nautical Charts.
3. SCAR Working Group on Geodesy and Geoinformation (Chair: John Manning)
The WG has demonstrated its interest in bathymetric charting by setting up and maintaining a list of bathymetric activities in Antarctica. For GEBCO this list serves as information tool and basis for the updating of their bathymetric product. The Recommendation SCAR XXV-9 includes a request for exchange of meta information about bathymetric surveys in the Antarctic Treaty Area. Data exchange between GEBCO and SCAR is practised since several years. The new IBCSO can be incorporated in the planned Cyber-Cartographic Atlas of Antarctica after completion. The members of the SCAR WG are encouraged to participate and actively collaborate in the program of IBCSO.

A fast and targeted creation of the IBCSO requires the establishment of a powerful Editorial Board and an active work team. For this purpose annual meetings or workshops must be carried out. Funding to organize and perform such meetings should be acquired. It is proposed to perform the meeting in connection with SCAR- and/or IHO/AHC-Meetings in order to minimised travel expenses.

A first informal one-day meeting for technical and organisational discussions is planned to take place on November 1, 2002, in connection with the IBCAO-Meeting in Honolulu, Hawaii. Interested members of the SCAR-WG are invited to participate.

A detailed technical and scientific plan and full proposal for the creation of the IBCSO will be presented at the meeting. A recommendation will than be passed to IOC inviting the commission to formally establish the IBCSO Editorial Board within its Ocean Mapping Program. SCAR and IHO shall serve as co-sponsors.

A new mailing list server was established and is maintained by the NGDC in Boulder, CO, USA. The mailing list can be used to send information to all members and collaborators involved in IBCSO. This list is password protected, but once subscribed, you can log onto the page and have your password resent (to your email address only).

To post to this list, send your email to:

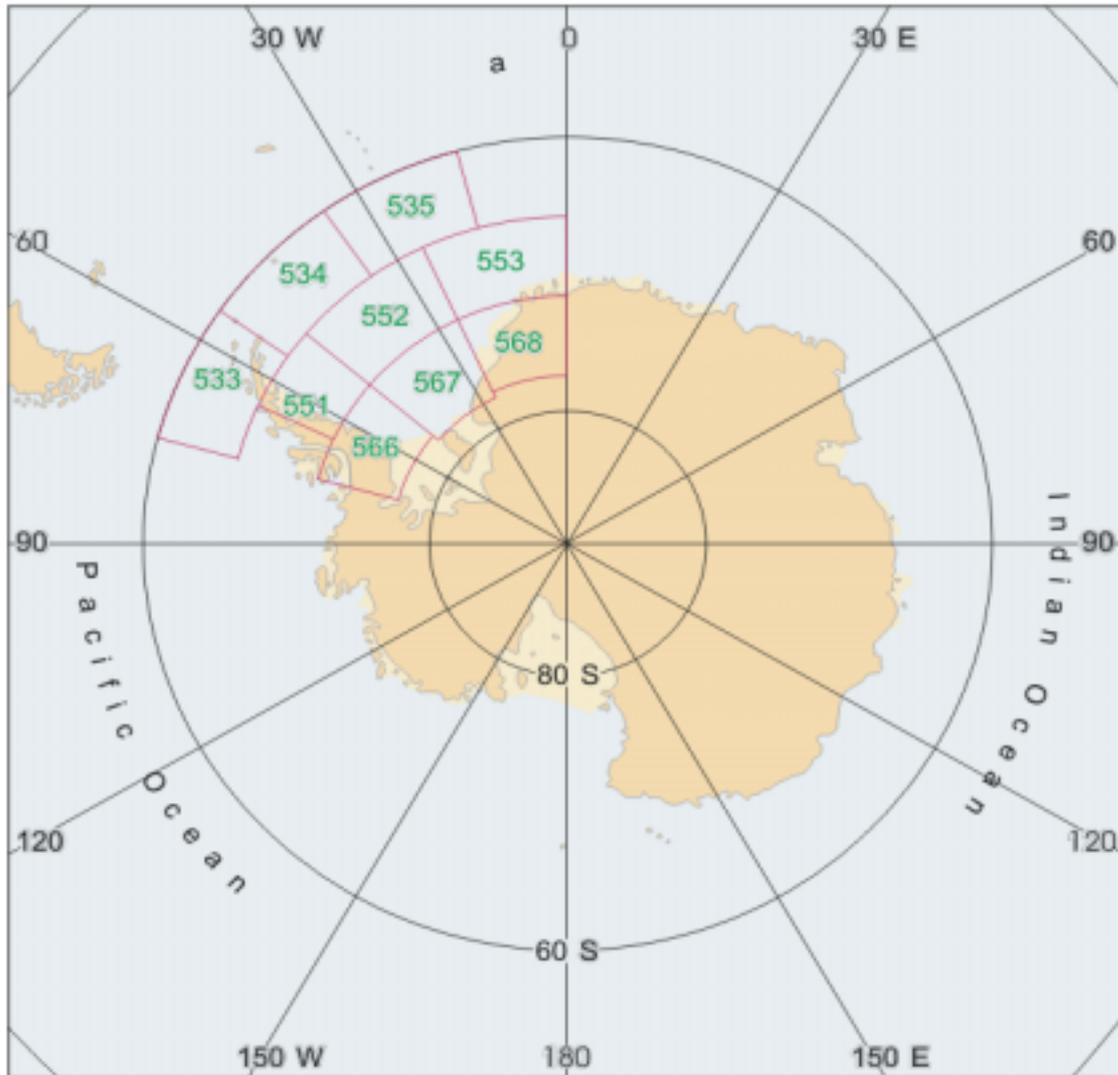
antarctic@mailman.ngdc.noaa.gov

General information about the mailing list is at:

<http://mailman.ngdc.noaa.gov/mailman/listinfo/antarctic>

Interested members of the SCAR WG GGI who like to collaborate within IBCSO are invited to join this mailing list.

Sheet Index of the AWI BCWS



Vertical reference system: Mean Sea Level (MSL)
Vertical datum: Instantaneous Sea Level

The map projection parameters are in accordance with the regulations of the IOC/IHO GESCO guidelines, IHS Bathymetric Publication No. B-7.
One millimetre on the map at the standard parallel represents one kilometre in natural scale on earth.
Chart datum is the instantaneous sea level at the time of observation. Tidal heights are in the order of 2 m. Depths are shown in metres assuming a sound velocity in water of 1500 m/s.
Conversion parameters (nominal values): to achieve elevations in feet multiply by 3.2808 and to achieve depths in fathoms multiply by 0.5498.

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Fig.: 1 Scheme of the AWI Bathymetric Chart of the Weddell Sea (BCWS) 1:1 Mio

Literature:

Macnab, R. and Jakobsson, M., 2000, Something old, something new: compiling historic and contemporary data to construct regional bathymetric maps, with the Arctic Ocean as a case study, *International Hydrographic Review*, v. 1, no. 1, p. 2-16

Schenke, H.W., et al., 1998, The New Bathymetric Charts of the Weddell Sea: AWI BCWS. In: St. Jacobs and R. Weiss, Editors, *Ocean, Ice, and Atmosphere: Interactions at the Antarctic Continental Margin*, Antarctic Research Series, Vol. 75, pp. 371-380

Smith, H.F.W., and D. T, Sandwell, Global Seafloor Topography from Satellite Altimetry and Ship Depth Soundings, *Science*, 277, 1956-1962, 1997.