

**IHO HYDROGRAPHIC COMMITTEE ON ANTARCTICA (HCA)
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**Report on the
International Bathymetric Chart of the Southern Ocean (IBCSO)**

**Hans Werner Schenke, Jan Erik Arndt
AWI Bremerhaven, Germany**

General

The work on the International Bathymetric Chart of the Southern Ocean (IBCSO) at the Alfred Wegener Institute for Polar and Marine Research (AWI) was interrupted between end of 2010 and Sept. 2011 due to shortage of staff. The completion of the data base and the buildup of the additional data layers like land/ice topography, nomenclature and sub-glacial topography was terminated in the summer 2012. The determination of the new bathymetric Digital Terrain Modell (DTM) with a resolution of 500 m by 500 m was finished in early September 2012. A first compilation of the new IBCSOv1 was presented at the GEBCO Meeting in Monaco on 1 October 2012. The IBCSOv1 will be published in December at the Fall meeting of the American Geophysical Union in December 2012. The DTM will be made available to the HCA in early 2013.

The IBCSO program was endorsed by international organizations such as the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the International Hydrographic Organization (IHO), and the Scientific Committee on Antarctic Research (SCAR).

Moreover, IBCSO is part of the ocean mapping program of the General Bathymetric Chart of the Oceans (GEBCO), in particular it is under the coordination of the Sub-Committee for Undersea Mapping (SCRUM).

Activities

For the generation of the first International Bathymetric Chart of the Southern Ocean the scientific editor and data manager collected all available bathymetric data, grids, and maps provided by scientific institutions, hydrographic offices, and international data centers. The IBCSO database comprises more than 4.000 million data points, of which approx. 98 % originate from 174 cruises with multibeam data.

Objectives

The Southern Ocean bathymetry defines ocean gateways and barriers. The sea floor topography controls ocean circulation and ocean mixing - and has strong influence on global climate. The transformation of multibeam data into classified products for coastal and marine research

supports protection and conservation of marine biodiversity. Furthermore, bathymetric data provide additional numerical descriptors of terrain variables.

The IBCSOv1 is the first bathymetric data compilation of the entire Southern Ocean. The Expert Group provides digital maps and terrain models to the scientific community, e.g. hydrographers, oceanographers, climatologists, biologists, geologists and geophysicists. IBCSO is additionally a contribution to the IOC/IHO General Bathymetric Chart of the Oceans (GEB-CO). The IBCSO database provides a homogenous and consistent grid to stakeholders as hydrographers or scientists for their specific use. This approach enables them to define and clip areas of interests from the dataset. Digital ship track inventories will be available from the bathymetric database which can be used for future ship track planning and optimized sonar data acquisition.

Multibeam Data

The generation of a first comprehensive bathymetric chart in Antarctic waters was an ambitious task, because bathymetric data are scattered worldwide in national and international databases, archives and repositories. Besides that, bathymetric data are very heterogenic in terms of age, acquisition system, accuracy, quality, processing level, documentation and format.

Only few research vessels (RVs) operating in the Southern Ocean are equipped with multi-beam echosounder (MBES). In summary 174 multi-beam surveys ranging from small to large survey areas were available (Table 1). Approximately 14.9 % of the bathymetric IBCSO grid cells are directly constrained by multibeam data and roundabout 3,964 million multi-beam data points were acquired in Antarctic waters south of 60°S. Major contributions of swath data are provided by RVs *NB Palmer*, *Polarstern*, *JC Ross*, *Explora*, and *Hespérides*. Swath data have also been acquired by RVs *Araon* (1), *L'Atalante* (1), *Ewing* (3), *Healy* (1), *Howard Burton* (1), *Knorr* (2), *Melville* (1), *Oden* (3), *Revelle* (4), *Surveyor* (1), and *Thombson* (1).

Table 1: Multibeam data used for the IBCSO

No.	Research Vessel	Cruises	Data points	Grid cells in IBCSO
1.	<i>Polarstern</i>	49	805.000.000	6,1 %
2.	<i>Nathaniel B. Palmer</i>	63	2.299.000.000	3,6 %
3.	<i>James Clark Ross</i>	30	569.000.000	1,8 %
4.	<i>Explora</i>	8	1.000.000 *	0,5 %
5.	<i>Hespérides</i>	5	1.000.000 *	0,6 %
6.	Others	19	289.000.000 **	2,3 %
	TOTAL	174	3.964.000.000 **	14,9 %

* Points from gridded multi-beam data; ** Points partly from gridded multi-beam data

Specifications for the IBCSO Grid

For the generation of the IBCSO following grid specifications were defined. The area covered is south of 60°S the Antarctic Treaty area, the coordinate system is a conformal polar stereo-

graphic projection (metric coordinates) on the WGS84 ellipsoid with true scale at 65°S. Table 2 gives an outline of the grid specifications.

Table 2: Specifications for the IBCSO grid generation

Parameter	Specification
Version	Bathymetry with bedrock topography
Coverage Area	South of 60°S latitude, including Antarctica
Coordinate System	Meters,
Map Projection	Polar Stereographic (true scale at 65°S)
Horizontal Datum	World Geodetic System 1984 (WGS 84)
Vertical Datum	Mean Sea Level (MSL)
Vertical Units	Meters
Grid Spacing	500 m
Grid Format	NetCDF, ArcGIS grid
Coastline	SCAR Antarctic Digital Database V6.0

IBCSOv1 Chart (draft)

A draft version of the IBCSOv1 map is shown in Fig. 1. The product includes several geographical layers. These are contour lines, color intervals and a hillshade layer from the IBCSO v1 bathymetry grid, two separate sets of contour lines for continental Antarctica, derived from the Bedmap2 seafloor elevation and ice surface elevation grids, coast- and grounding lines, areas of rock outcrop, and permanent stations from the SCAR Antarctic Digital Database Version 6, geographic names of limits of the seas from IHO's S-23 (1953), geographic names of undersea features from the GEBCO Sub-Committee for Undersea Feature Names (SCUFN) gazetteer, and topographic names in Antarctica from the SCAR Composite Gazetteer of Antarctic Place Names (CGA). The selection of geographic features from the Gazetteers and the placing of the names were performed at an IBCSO Editorial Board meeting in April 2012.

by now. The international outreach of the IBCSOv1 release possibly can give reason to recognize and obtain unknown bathymetric data.

For future survey planning IBCSOv1 and its Source ID grid will serve as base information where data has already been acquired. It supports a more efficient survey of the Southern Ocean. The new SCAR SSG-GS Action Group “Multibeam” may be considered a signal for growing interest of the scientific community to generally acquire more multibeam data and to cooperate between institutions in the planning of future surveys by exchanging track planning.

The bathymetric data held by IHO Member States in Electronic Navigational Charts (ENC) is another valuable data source which could be used for the IBCSO grid in Antarctic coastal and shallow waters (INT Region ‘M’: see Figure 1). These regions are of special interest because of significant depth differences (400-800 m) between global data sets such as ETOPO1 and GEBCO. Use of ENCs will support quality assessment of calculated grids and contours. Import of ENC data into an ArcGIS geodatabase based on the S-57 data model can be realized by the ENC Data Handler extension for ArcGIS.

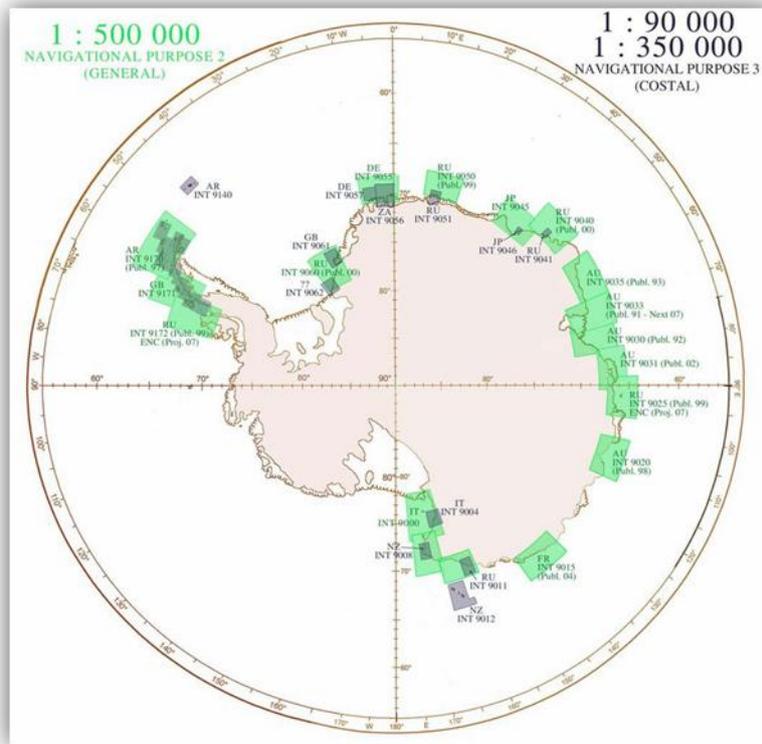


Figure 1: ENC scheme for medium scales in Antarctica (image source: IHO, 2008).