IBCAO and IBCSO:
Particular Importance of Digital Bathymetry in Polar Regions

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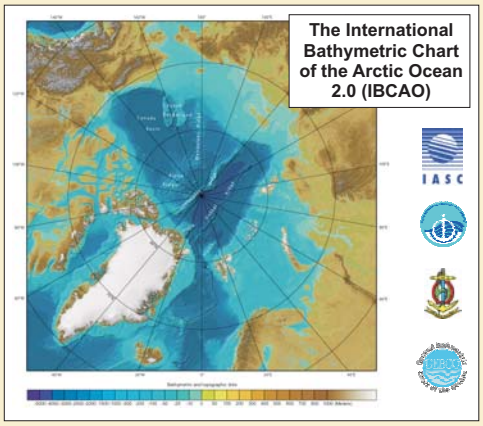
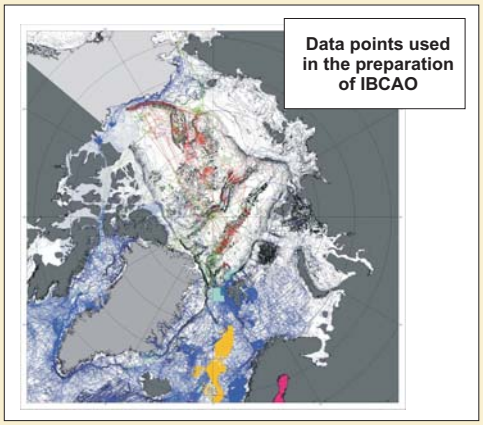
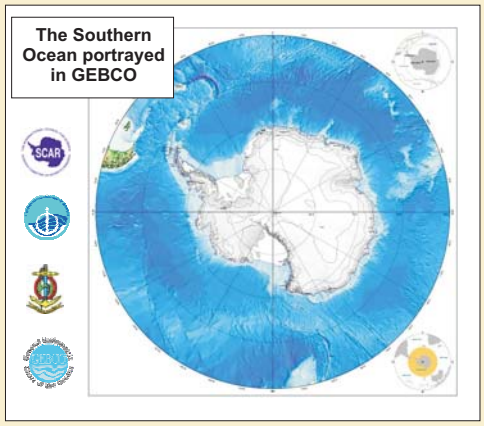
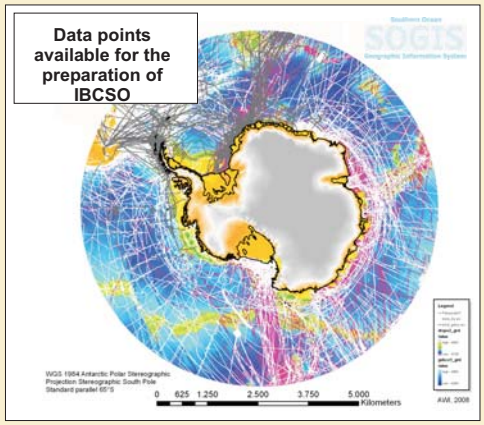
International Bathymetric Chart of the Arctic Ocean





International Bathymetric Chart of the Southern Ocean





Current compilation initiatives

Two international initiatives maintain bathymetric databases for use in construction of detailed portrayals of the sea floor in the polar regions: the International Bathymetric Chart of the Arctic Ocean **(IBCAO)** and the International Bathymetric Chart of the Southern Ocean **(IBCSO)**.

IBCAO and IBCSO have been endorsed by the International Arctic Science Committee (IASC) and the Scientific Committee on Antarctic Research (SCAR), respectively. The technical integrity of both projects is assured through ongoing liaison with the Intergovernmental Oceanographic Commission (IOC) and the International Hydrographic Organization (IHO).

The IBCAO started in 1997. The first version was released in 1999; an updated second version is currently published in 2008. The IBCSO started late 2006; a first version is probably available in 2009.

Bathymetric patchwork

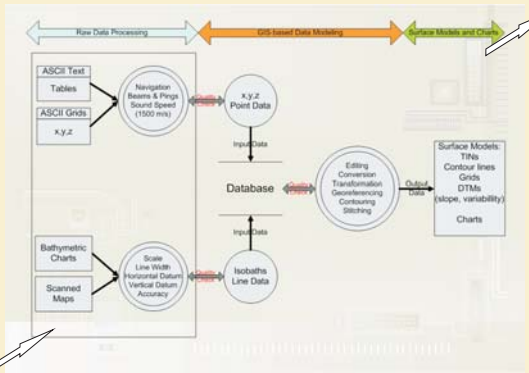
IBCAO is a seamless bathymetric-topographic Digital Terrain Model that incorporates three primary data sets: all available bathymetric data; the USGS GTOPO30 topographic data; and the World Vector Shoreline for coastline representation. The grid cell size of the updated version is 2 x 2 km on a Polar Stereographic projection. The IBCAO bathymetric database includes soundings, isobaths and depth soundings from published maps.

In the course of the IBCSO project its emphasis shifted from ocean mapping to a GIS based data compilation entitled 'SOGIS'. This implies integration of topographic and bathymetric data with geoscientific data of Antarctica and the Southern Ocean. Bathymetric data are provided by data centers, hydrographic offices, and scientific institutions. The grid cell size is determined by 2.5 x 2.5 km in Southern Polar Stereographic projection and by a 1' x 1' geographic grid.

From data compilation ...

IBCAO and IBCSO are the first International Bathymetric Charts of the IOC implemented in Geographic Information Systems (GIS). Based on regular grids with depth values, digital terrain models can be manipulated in a variety of computational processes. Additionally, consequent use of digital data speeds up data exchange, data modeling and publication of results, comprising cartographic charts and digital maps. Important byproducts are consistent bathymetric databases, related meta-information, and efficient working groups.

A flow chart demonstrates the complex GIS based data processing prior to the gridding and map generation. Processing comprises (i) quality check and editing of single- and multibeam data, (ii) stitching of individual data sets to a consistent bathymetric patchwork, (iii) various filter operations during the iterative gridding process, and (iv) contouring for the generation of the final bathymetric charts.



Sea floor topography in ...

The significance of the sea floor topography is reflected by the full spectrum of applications in Geosciences, Life Sciences, Physical Sciences and Ocean Observing Systems. International collaboration is mutually agreed with other polar efforts and projects.

Major currents respond to bathymetry. The shape of the sea floor shows strong influence on thermohaline circulation and ocean mixing with bottom water formation, fresh water flux, and carbon sink - and hence has strong influence on global climate. But poor knowledge of bathymetry is the limiting factor for new progress in ocean models.

The transformation of multi-beam data into Digital Terrain Model derivatives like slope, aspect, and variability enables predictive habitat modeling. Multi-scale terrain analysis for the description and conservation of unique polar ecosystems is also improved by accurate bathymetry.

... to surface models and chart series

Main work of mixing and blending bathymetric data consists of checking the depth soundings for inconsistencies, e.g. outliers. Filtering and gridding algorithms are used to create a coherent grid from the assimilated bathymetric data, because grid-based data is better suited for the representation of continuous surfaces than vector data. Major advantage of the cell-based data model is the enormous analytical capabilities.

Contour lines (isobaths) of constant depth values at a specified interval are probably the most familiar representation of terrain surfaces in bathymetric charts. Contouring is performed by interpolation of known values and comprises linear and non-linear filtering or polynomial interpolation, e.g. B-Splines. Additionally, GIS based analysis provides different types of surface models (regular or irregular spaced) to the scientific community.

... interdisciplinary research

Accurate bathymetry is of great importance for modeling and understanding of crustal dynamics and crustal behaviour, including sedimentation processes, and tectonic activities for use in paleobathymetric map construction. Ocean gateways in polar regions act as key regulators for physical and biogeochemical processes.

Understanding the tectonic history of the Arctic and the Southern Ocean can clarify interconnections among tectonic processes, climate variability and its consequences on polar ecological niches and complex ecosystems at a global scale.

IBCAO and IBCSO provide services and products to the scientific community, amongst others hydrographers, oceanographers, climatologists, biologists, geologists, and geophysicists. To improve the underlying bathymetric databases both initiatives need continuous support with special emphasis on bathymetric data acquisition and data exchange.

IBCAO contact addresses

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Information about IBCAO: www.ibcao.org

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Information about IBCSO: www.ibcso.org