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Geographic Information Systems Tools for Collecting and Accessing Arctic Bathymetry: International Bathymetric Chart of the Arctic Ocean

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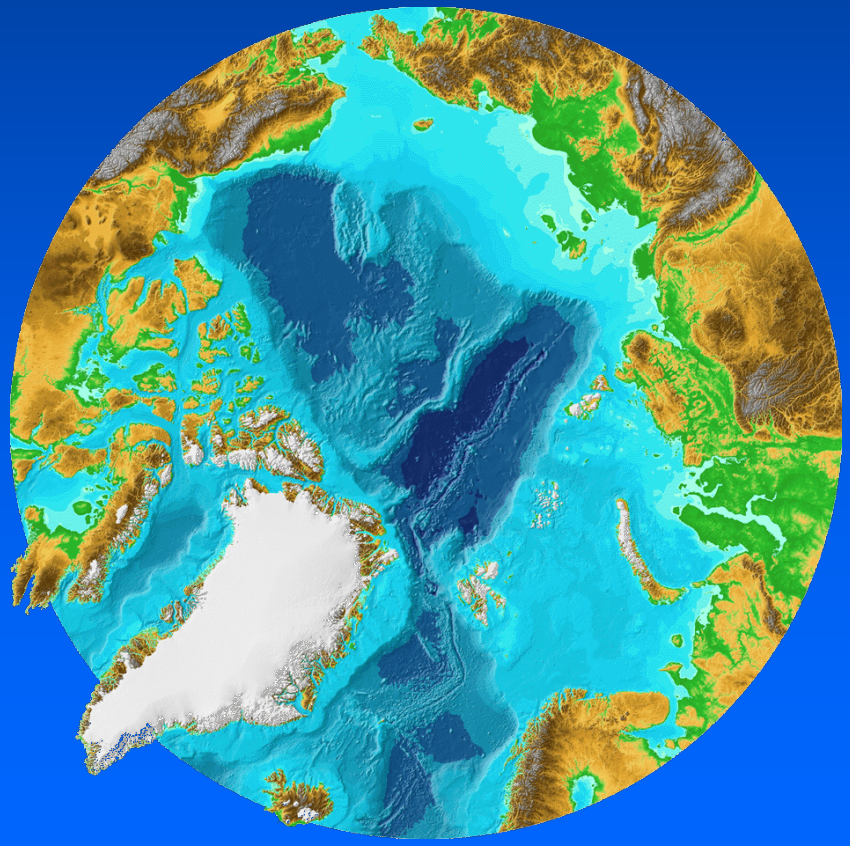
GIS Tools for Accessing Arctic Bathymetry:
International Bathymetric Chart of the Arctic Ocean (IBCAO)



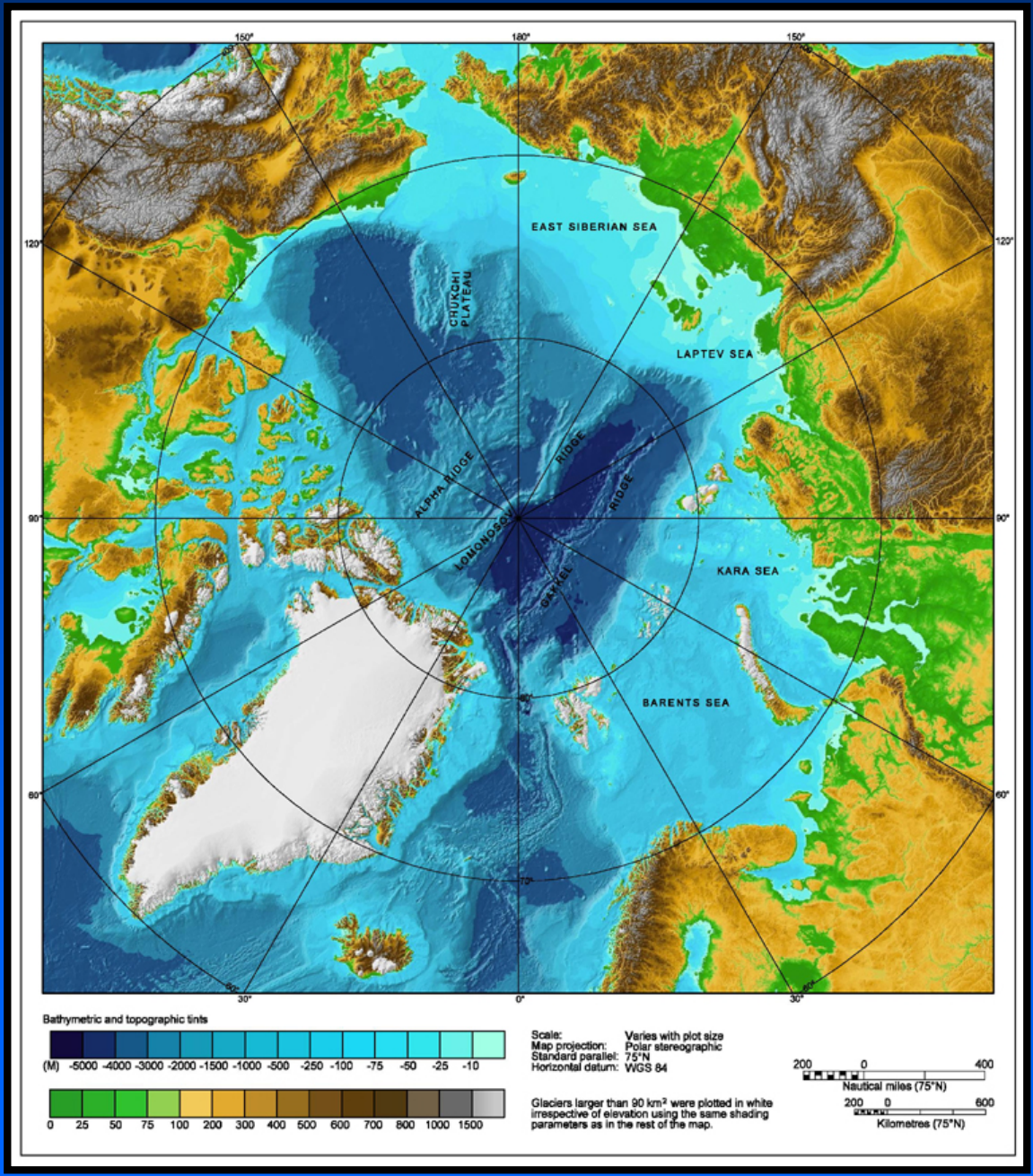
Martin Jakobsson

Center for Coastal and Ocean Mapping

Joint Hydrographic Center

University of New Hampshire

1. The IBCAO bathymetry model
2. Users of IBCAO
3. GIS tools for accessing the IBCAO grid model
4. Future IBCAO GIS products (Error estimation of the IBCAO bathymetry, vector contours)



IBCAO

Grid model representing Arctic Ocean bathymetry and topography

Grid cell spacing:

2.5 x 2.5 km

Projection:

Polar stereographic

True scale: 75º N

Datum: WGS 84

TRACKLINE SOURCES

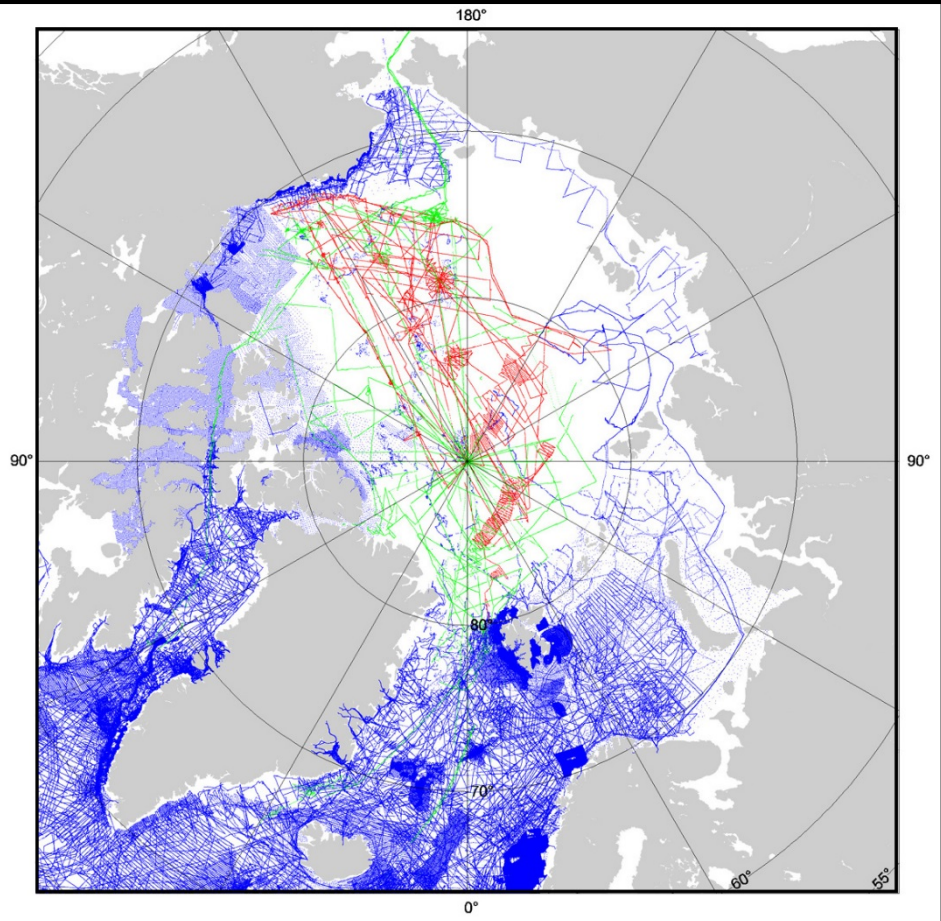
US and British Royal Navy nuclear submarine cruises (1958 - 1988).

Soundings collected by nuclear submarines during the SCICEX program (1993-1999

Soundings collected by surface vessels primarely obtained from four archives:

(1) the US National Geophysical Data Center (NGDC)
(2) the US Naval Research Laboratory (NRL)
(3) the Canadian Hydrographic Service (CHS)
(4) the Royal Danish Administration of Navigation and Hydrography (RDANH)

Recent acquisitions provided by agencies that mobilized missions aboard the Swedish icebreaker Oden (1991, 1996) and the German research vessel Polarstern (1990, 1994, 1995, 1997) are also marked in blue.



MAP SOURCES

Contours drawn during this present work in order to faciliate the computer gridding.

Navigational charts published by the Russian Federation's Head Department of Navigation and Oceanography (HDNO).

Newly-published Russian map (Head Dep. of Navigation and Oceanography et al., 1999).

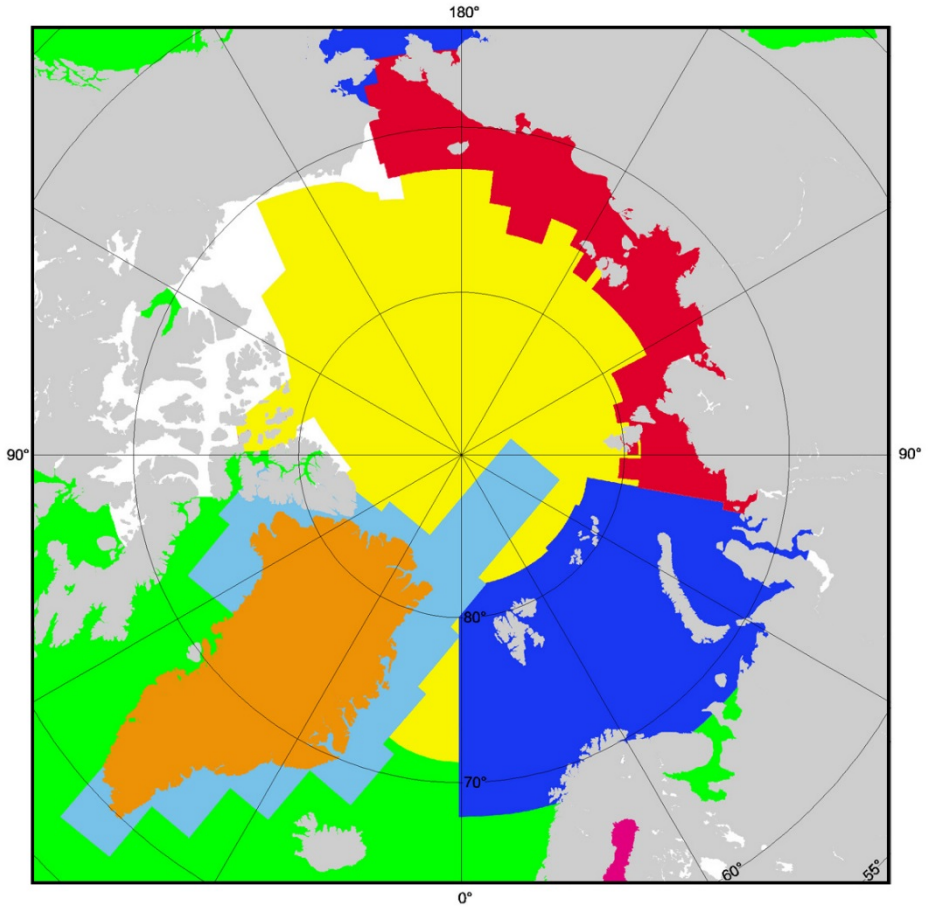
Bathymetry in the Gulf of Bothnia was derived from a digital grid compiled by Seifert and Kayser (1995).

Charts published by the US Naval Research Laboratory (Perry et al., 1985; Cherkis et al., 1991; Matishov et al., 1995).

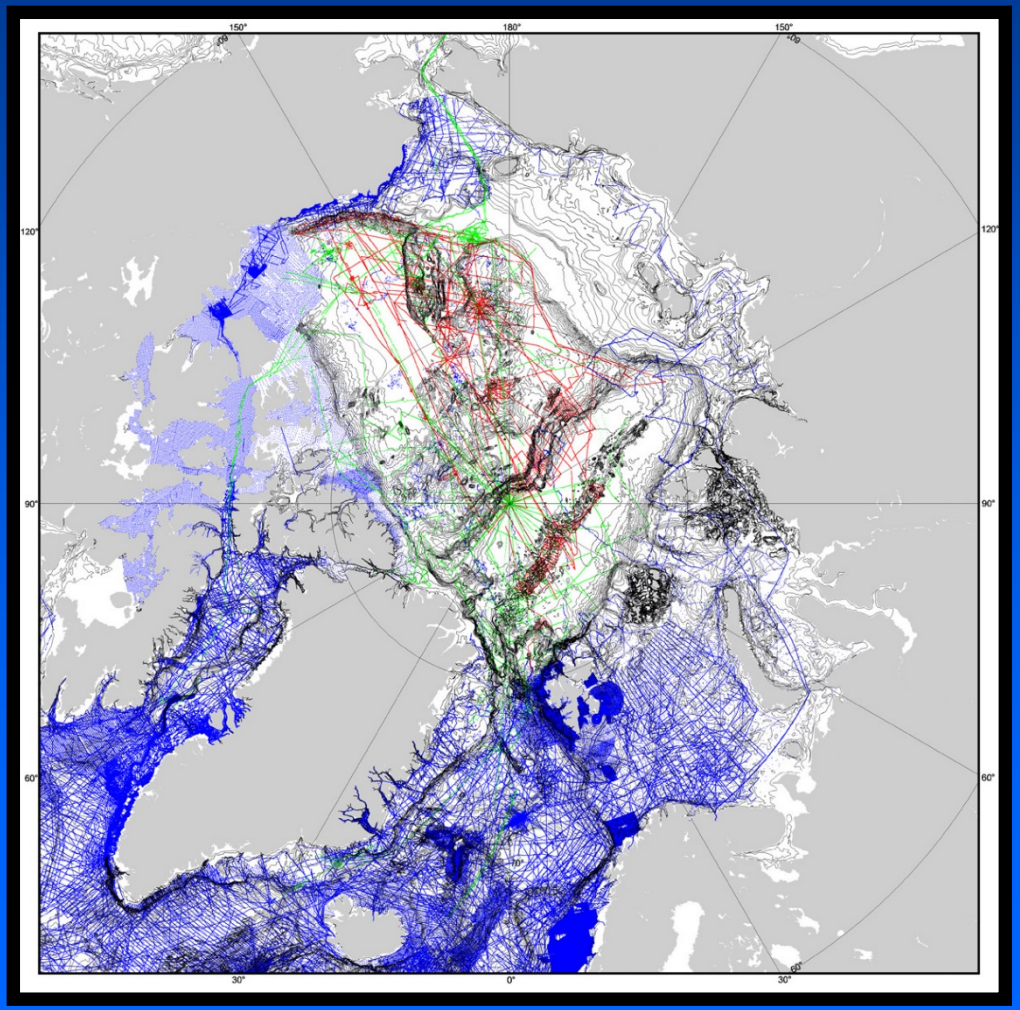
Contours retrieved from GEBCO Digital Atlas.

Greenland DTM developed by KMS, the Danish Cadaster and Mapping Agency (Ekholm, 1996).

GTOPO30 topographic model (U.S. Geological Survey, 1997).



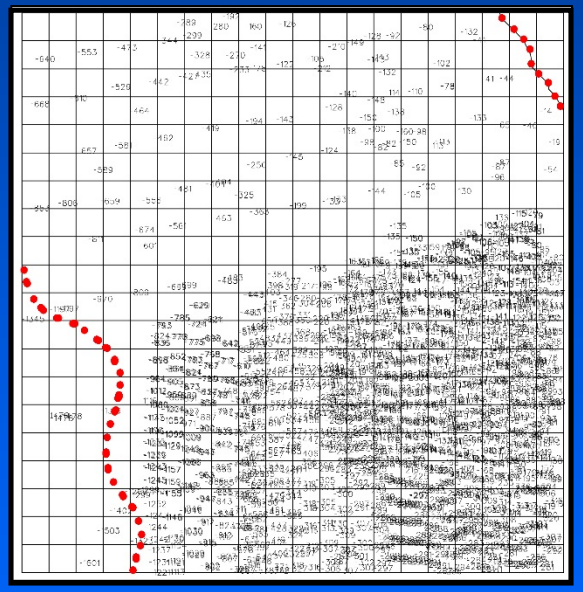
SOURCES



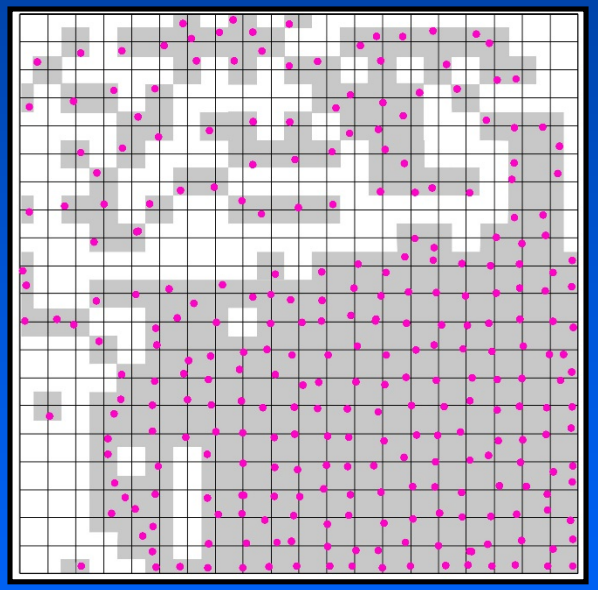
GRID COMPILATION

Data gathering (MGE)

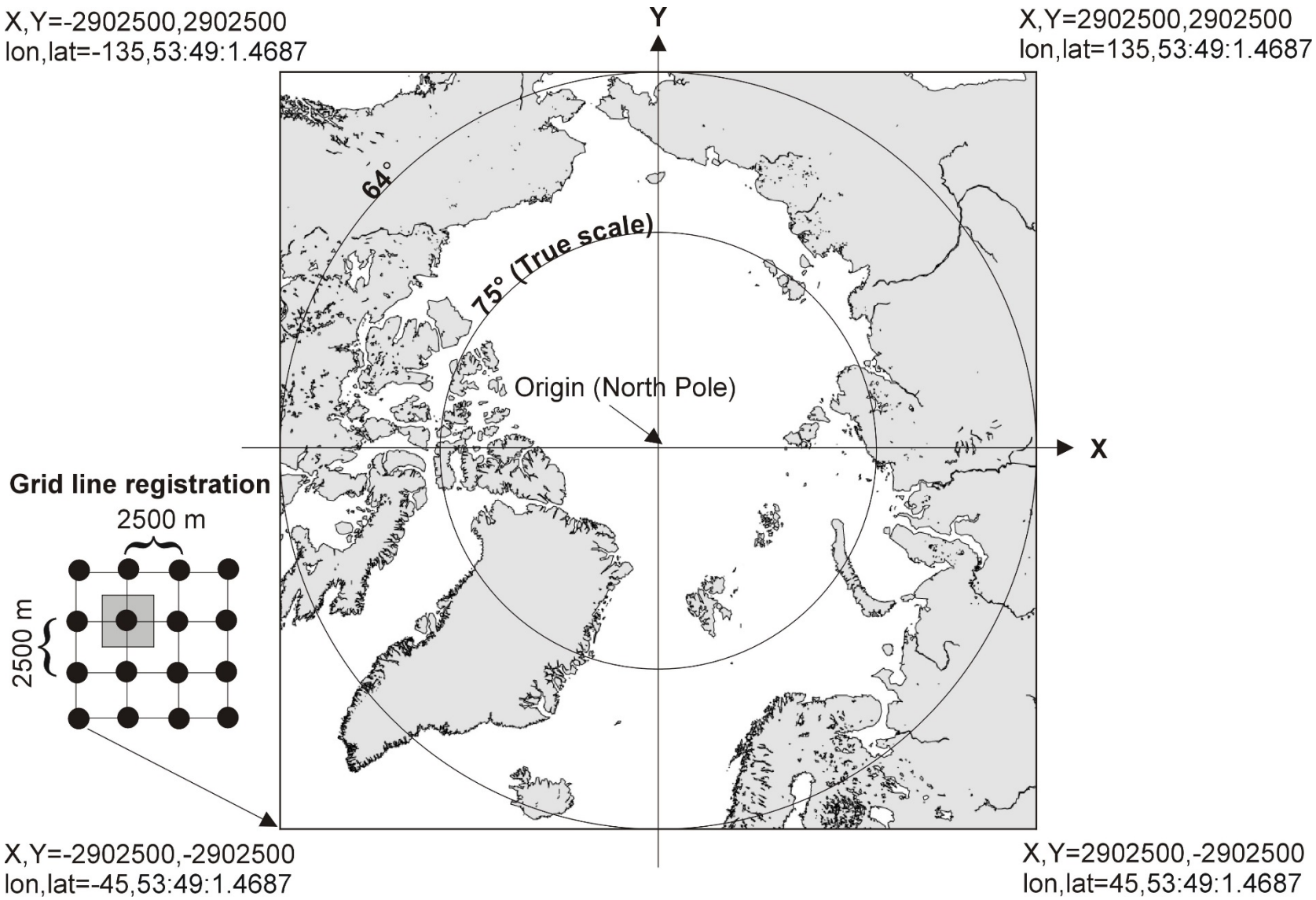
Data cleaning & mining (MGE)

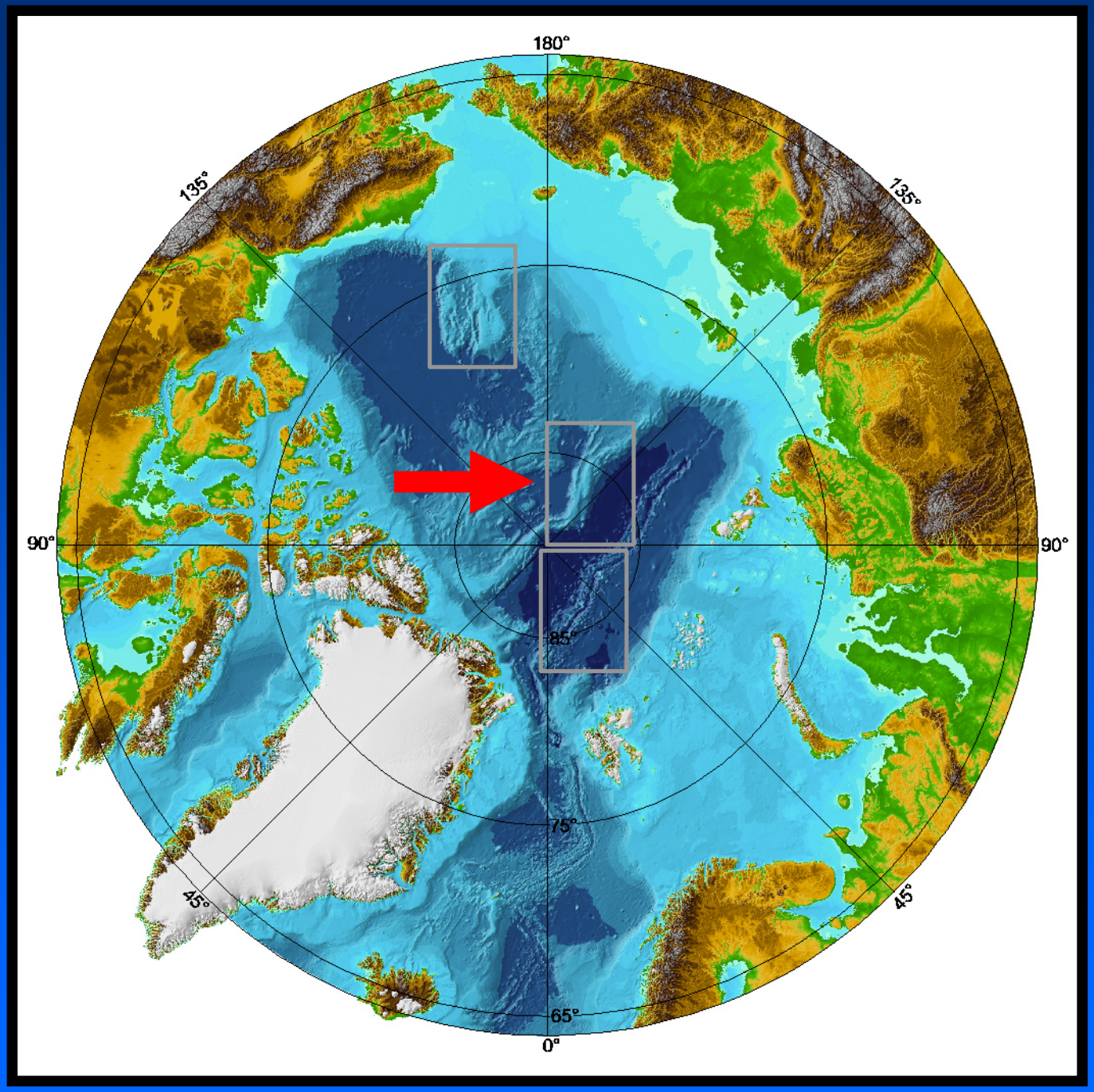


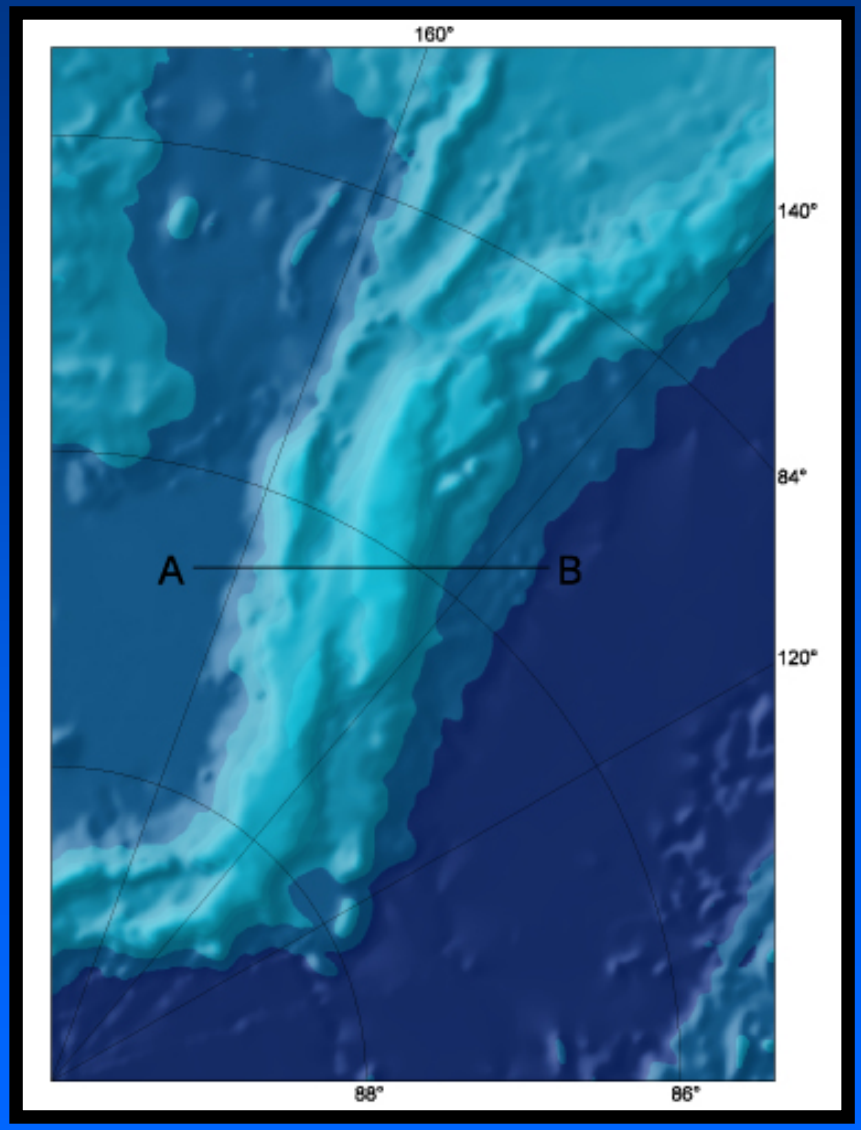
Block median filtering

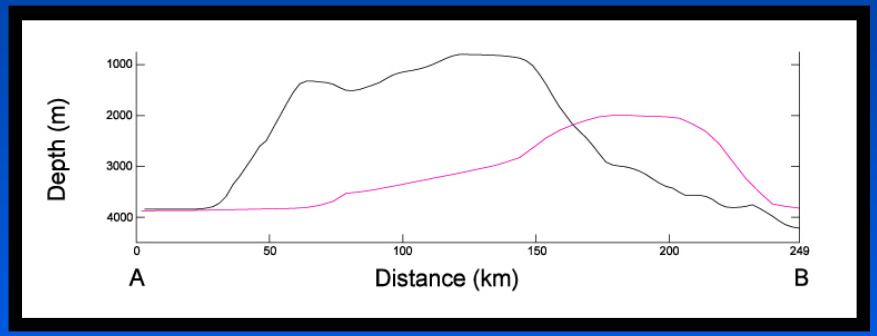


Gridding using continuous curvature splines in tension (Smith & Wessel, 1990)


X,Y=-2902500,2902500
lon,lat=-135,53:49:1.4687
Y
X,Y=2902500,2902500
lon,lat=135,53:49:1.4687
64°
75° (True scale)
Origin (North Pole)
X
Grid line registration
2500 m
2500 m
X,Y=-2902500,-2902500
lon,lat=-45,53:49:1.4687
X,Y=2902500,-2902500
lon,lat=45,53:49:1.4687


180°
135°
135°
90°
90°
85°
75°
45°
45°
65°
0°


160°
140°
84°
120°
A
B
88°
86°


Depth (m)
1000
2000
3000
4000
0
50
100
150
200
249
A
Distance (km)
B

IBCAO web site:

http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/arctic.html

IOC IHO IASC -International Bathymetric Chart of the Arctic Ocean (IBCAO) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites History

Address http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/arctic.html Go Links

International Bathymetric Chart of the Arctic Ocean (IBCAO)

- Editorial Board Members Nov 1999
- GEBCO (1979) & IBCAO (2000) maps, selective comparisons

PDF version **(1.7M, requires 4.0 reader)**

- IBCAO Technical Reference & User's Guide **(PDF file, 5.99M, requires 4.0 reader) (color file)**
- Reports & Posters
- Related WWW Sites

Project Overview

The goal of this initiative is to develop a digital data base that contains all available bathymetric data north of 64 degrees North, for use by mapmakers, researchers, and others whose work requires a detailed and acurate knowledge of the depth and the shape of the Arctic seabed.

Initiated in 1997, this undertaking has so far engaged the volunteer efforts of investigators who are affiliated with eleven institutions in eight countries: Canada, Denmark, Germany, Iceland, Norway, Russia, Sweden, and the USA. The activity has also been endorsed and/or supported financially by the Intergovernmental Oceanographic Commission (IOC), the International Arctic Science Committee (IASC), the International Hydrographic Organization (IHO), the US Office of Naval Research (ONR), and the US National Geophysical Data Center (NGDC).

A Beta version of the IBCAO Grid is available for user evaluation, as well as a provisional version of the IBCAO Map. We'd appreciate feedback on how to improve these products, along with information that would help us obtain new data sets for enhancing the IBCAO data base.

Click here to view the provisional map	Click here to download the Beta Grid	Click here to add your e-mail address to our mailing list	Click here to register comments and/or tell us about new data sets

URL: http://www.ngdc.noaa.gov/mgg/bathymetry/arctic/arctic.html
maintained by: NOAA/NGDC&WDC for MGG, Boulder

Done Internet

USERS OF THE IBCAO BATHYMETRY GRID

Oceanography modeling (e.g. Arctic ice-ocean model for the Polar Ice prediction System (PIPS), US Naval Postgraduate School; ARCICE, Southampton Oceanography Centre, UK)

Geophysical modeling

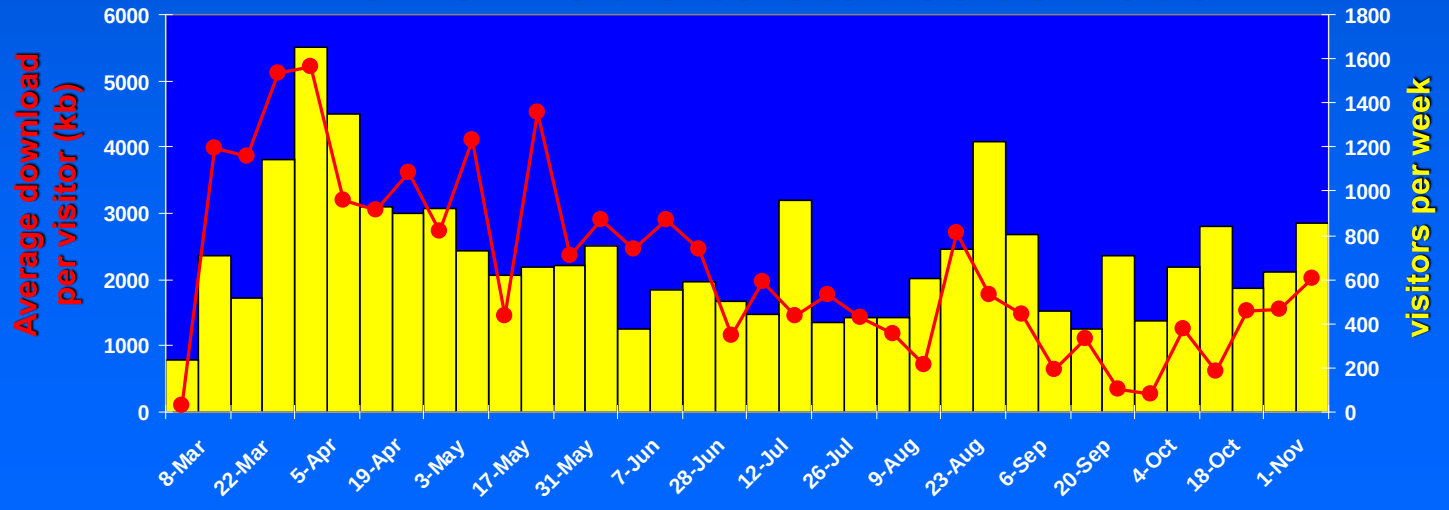
Ice sheet modeling

Cartographic applications

IBCAO web site news:

February, 26 652 accesses and 99297 hits

IBCAO web site statistics 2000



GIS Tools for accessing the IBCAO model

ESRI: ArcView, ArcInfo (Spatial Analyst, Arc Grid)

Intergraph: MGE (Terrain Analyst)

Geomedia (MFworks from ThinkSpace Inc.)

Clarks Labs: Idrisi32

Caris: HIPS

Geophysical and Mapping softwares

IVS: **Fledermaus**

Public domain: **Generic Mapping Tools**

Web GIS tools

Intergraph: **Geomedia Web Map**

ESRI: **ArcIMS3**

THE NESSECITY FOR AN ERROR ESTIMATION

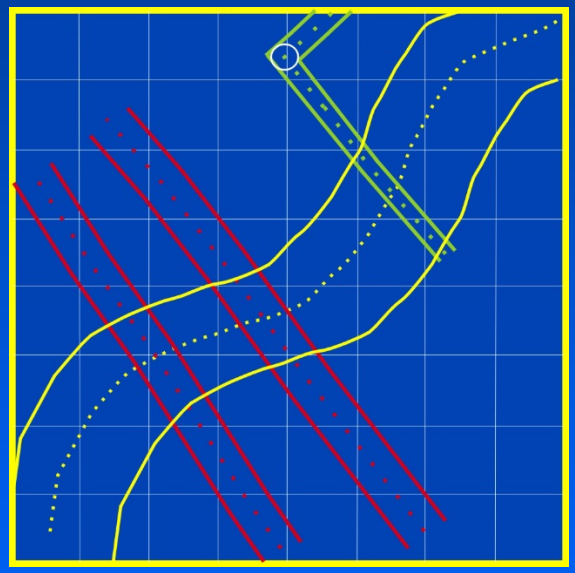
Regional grid models representing bathymetry/topography are often used as a base for oceanographic/climate/geophysical/ice sheet modeling

The modeling results are often interpreted without knowledge of the spatial differences in reliability of the underlying bathymetry/topography model

The idea is to create a grid with the same structure as the bathymetry/topography grid containing an estimate of the standard deviation of the errors of the bathymetry/topography

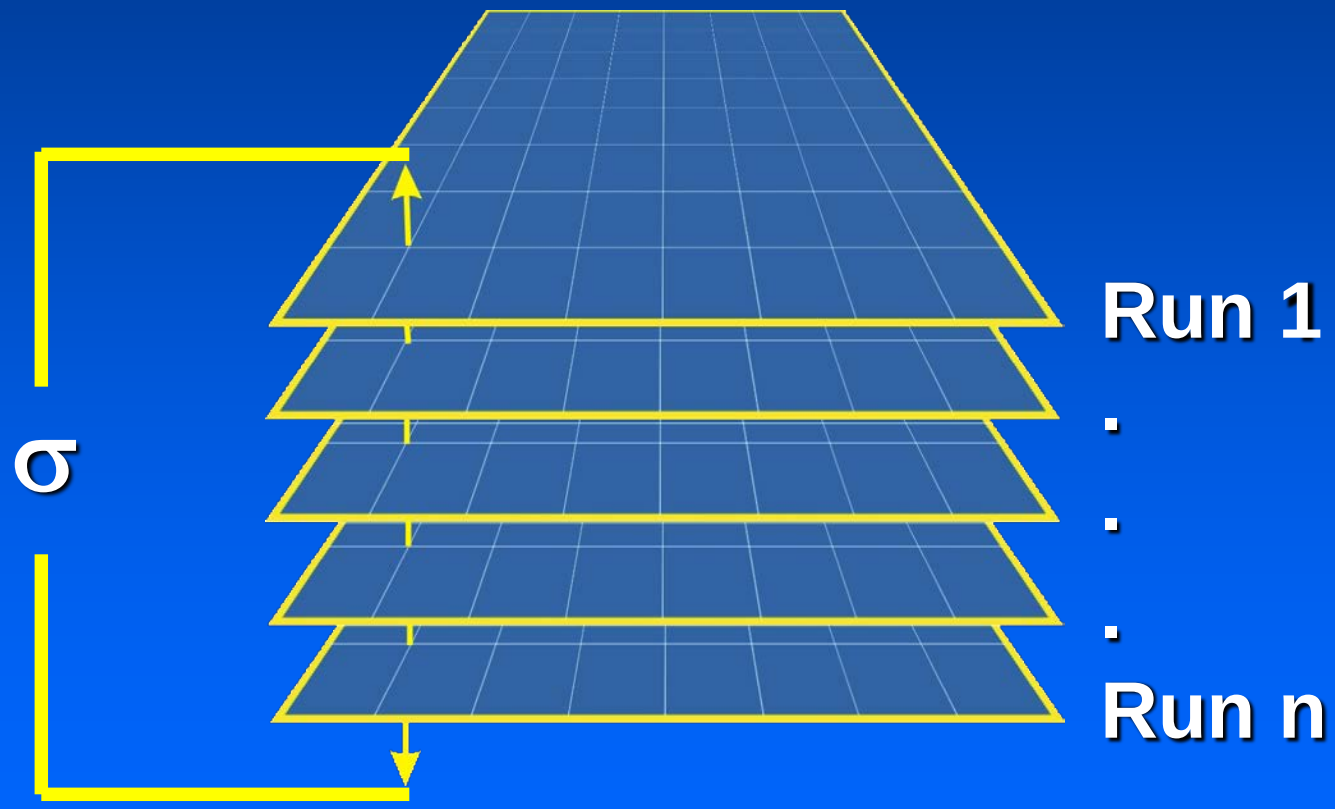
USING THE MONTE CARLO METHOD FOR ERROR ESTIMATION

1. Randomly vary the source data within constraints determined by meta data (navigation, echo sounder etc)
2. Go through the process with which the bathymetry grid is compiled (block median filtering + continuous curvature splines in tension)



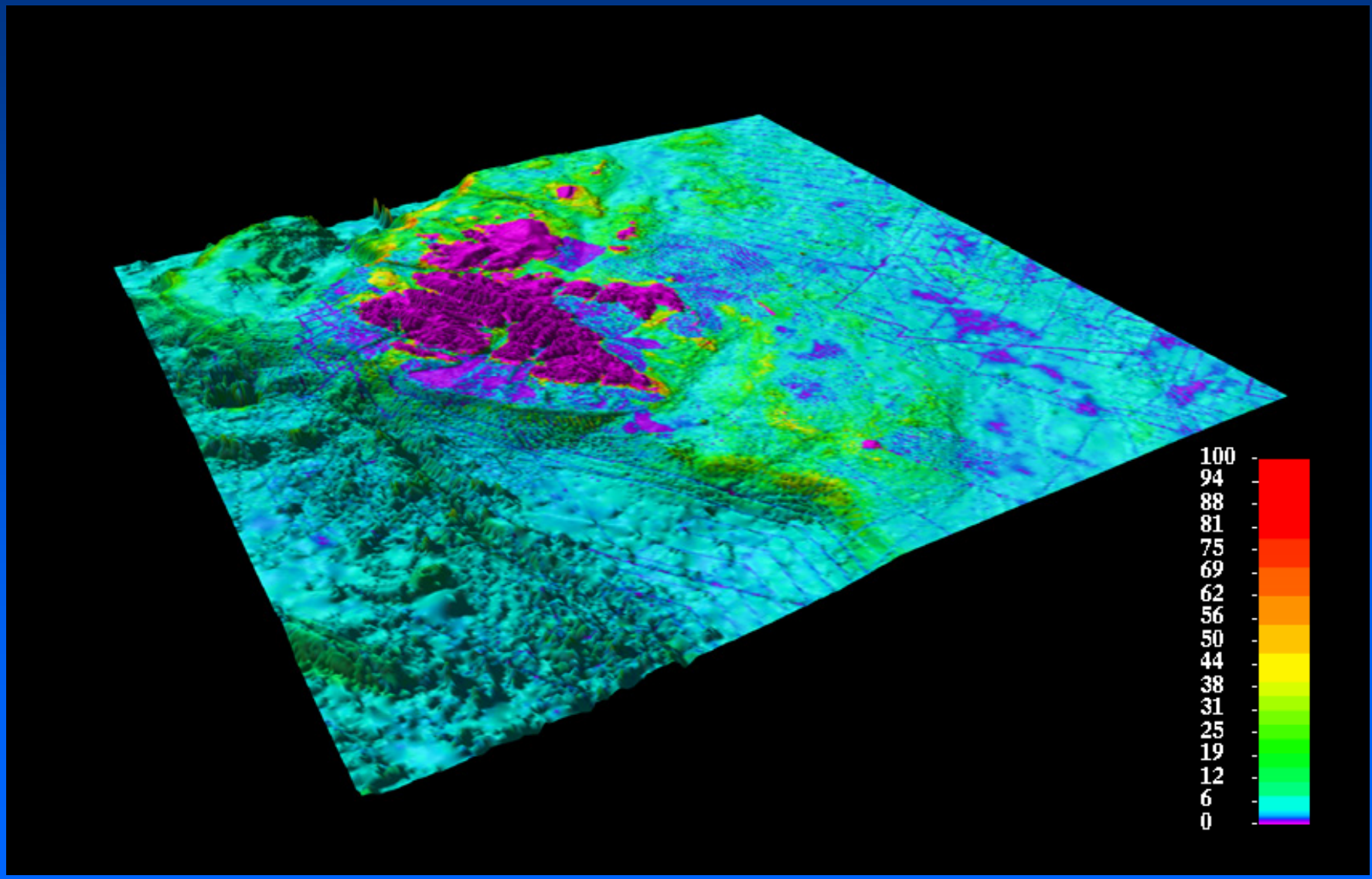
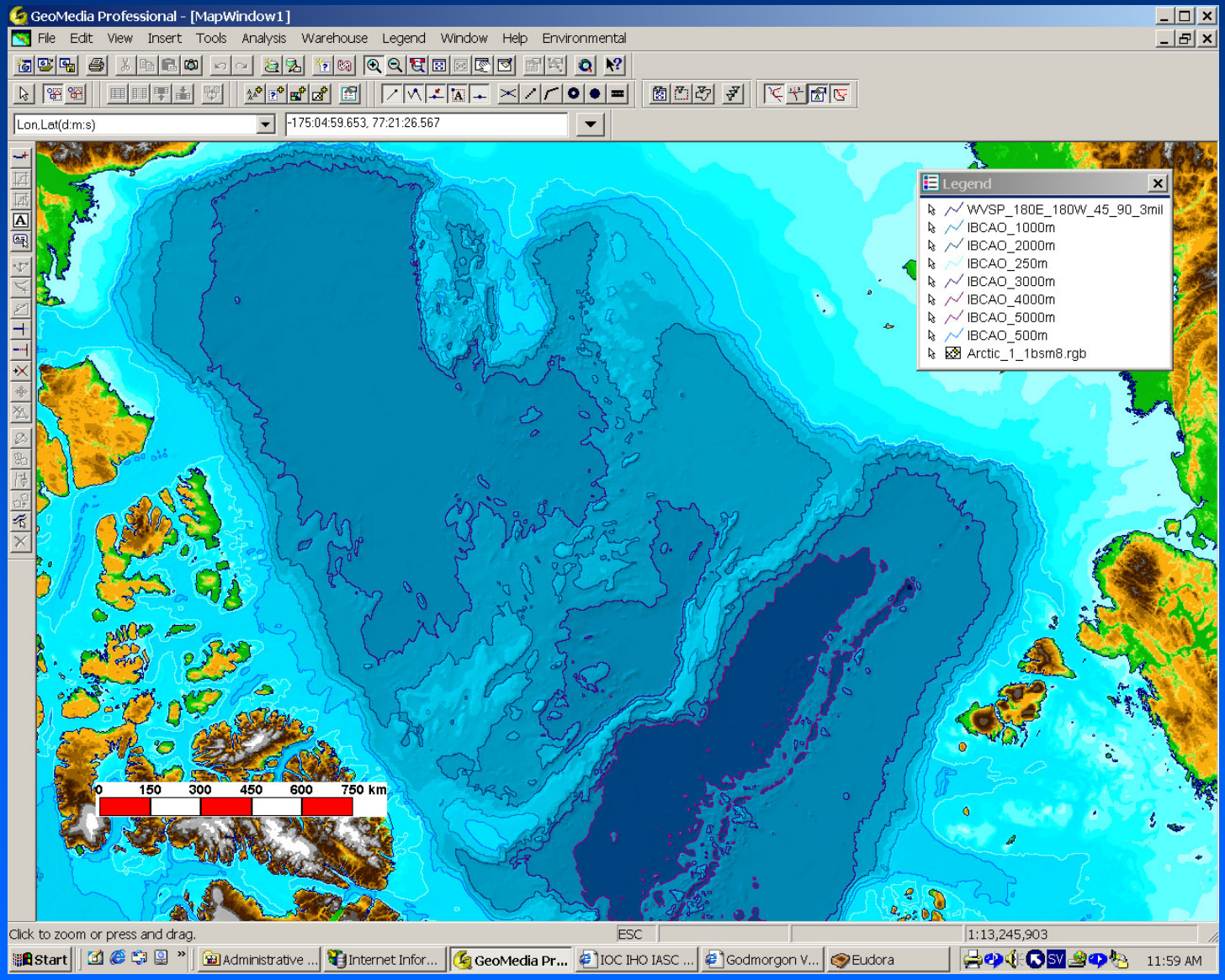
This processes are continued until……

STATISTICS



Standard deviation of estimated error

(% of block median depth)



IBCAO contours in Geomedia