

Status of U.S. Arctic ECS Mapping Activities

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NOAA/UNH
Joint Hydrographic
Center



**4th Symposium on the Impacts of an Ice-Diminishing
Arctic on Naval and Maritime Operations**
Washington, D.C., June 22, 2011

USCGC Healy



Length, Overall = 128 meters	Beam = 25 m	Propulsion = Diesel/Electric
Displacement = 16,000 LT	Shaft HP = 30,000 HP	Props = 2 fixed pitch
Cruising Speed = 12 knots.	Max Speed – 17 kts	Fuel Cap = 4.62 M liters
Icebreaking = 1.4 m continuous, 2.44 m backing and ramming		
Accommodations = 19 Officer, 12 CPO, 54 enlisted, 35 (+15) scientist		

Full suite of scientific gear including:

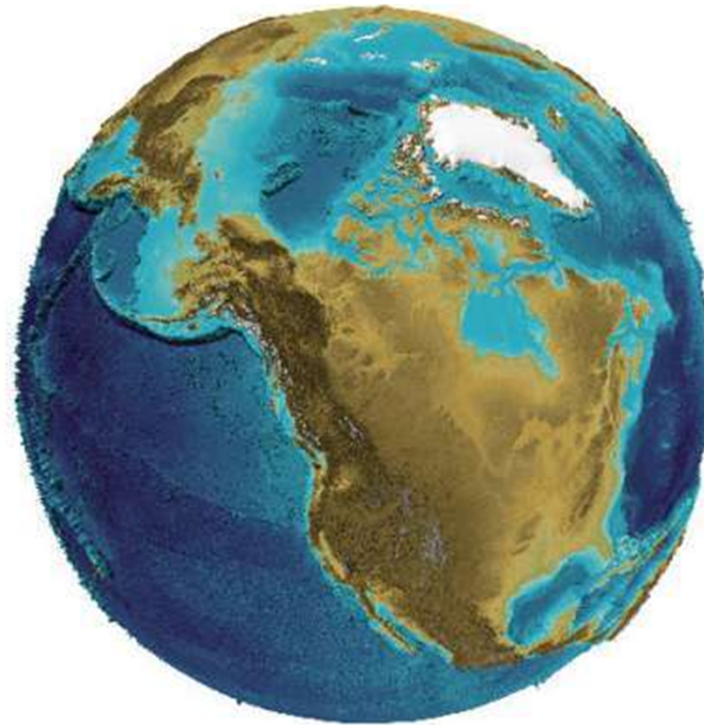
2001-2009 – Seabeam 2112 2x2 deg 12 kHz MBES

Now – Kongsberg EM122 – 1x1 deg 12 kHz MBES



**The Compilation and Analysis of Data Relevant to a U.S. Claim
Under United Nations Law of the Sea Article 76:
A Preliminary Report**

<http://www.ccom.unh.edu>



Center for Coastal and Ocean Mapping/Joint Hydrographic Center
University of New Hampshire

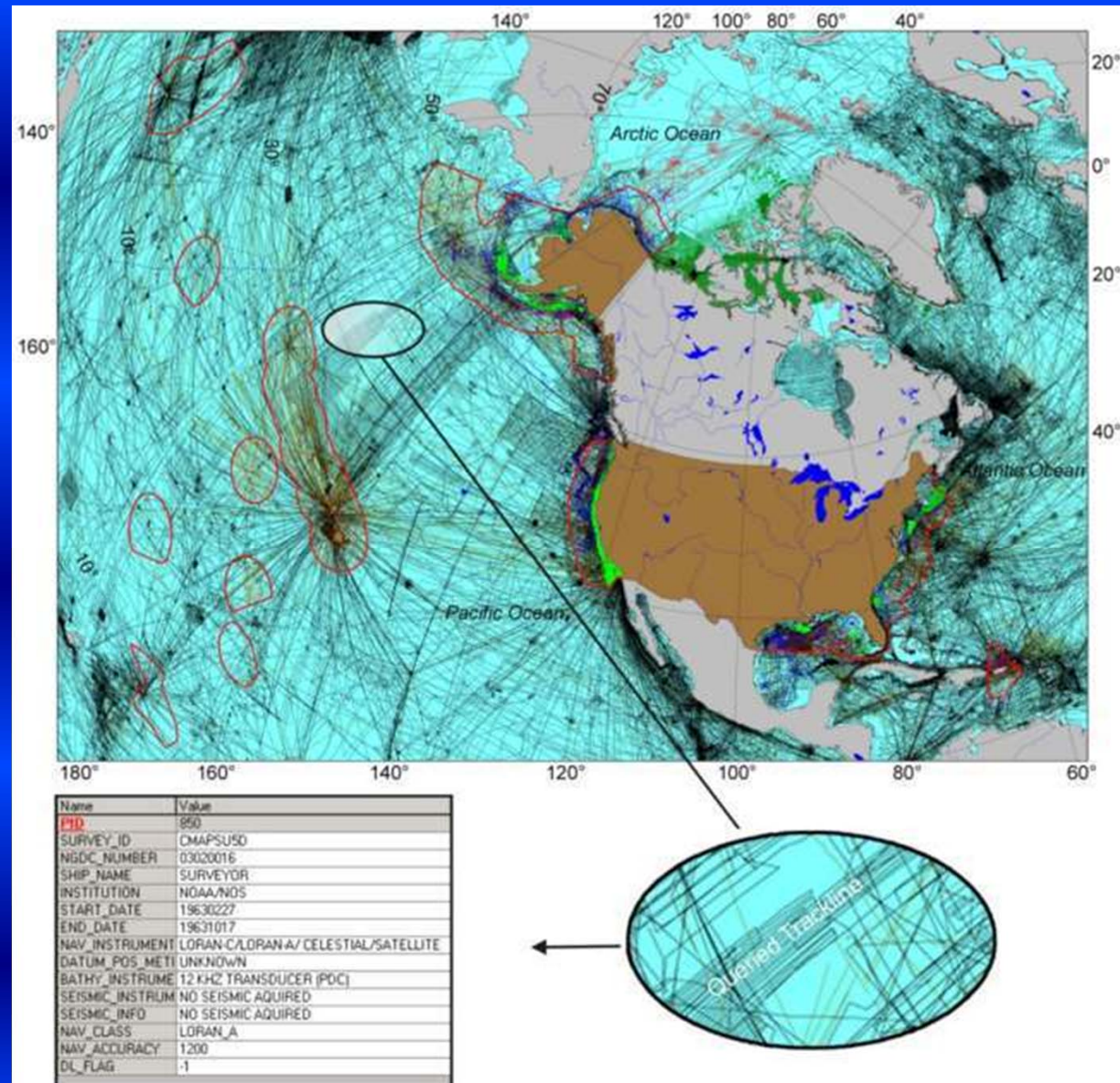
Durham, N.H.
May, 2002

Larry Mayer, Martin Jakobsson and Andrew Armstrong



Initial LoS Database

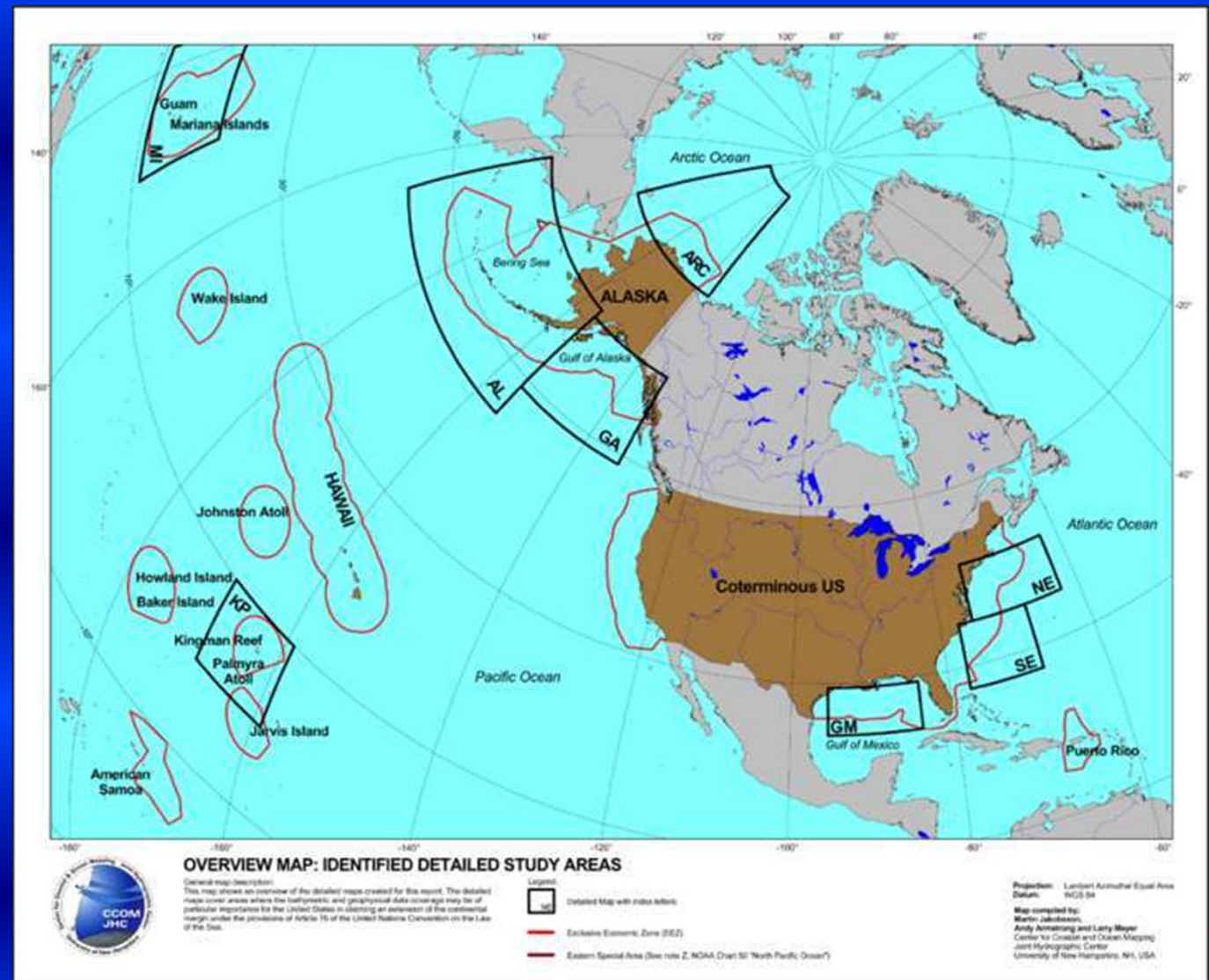
- 39861 tracklines
- 6037 survey polygons
- millions of soundings
- data compilations



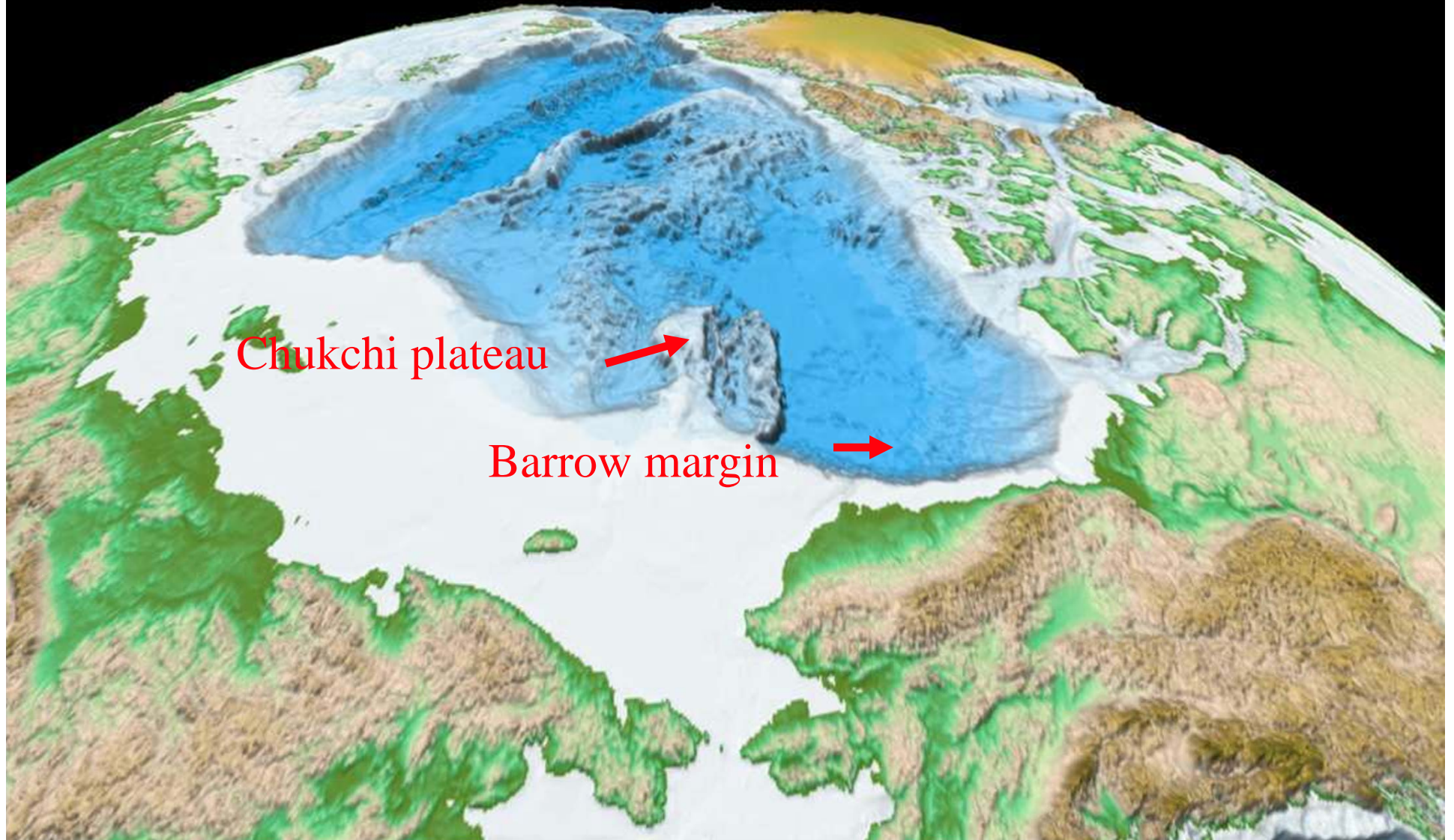
Initial Analysis

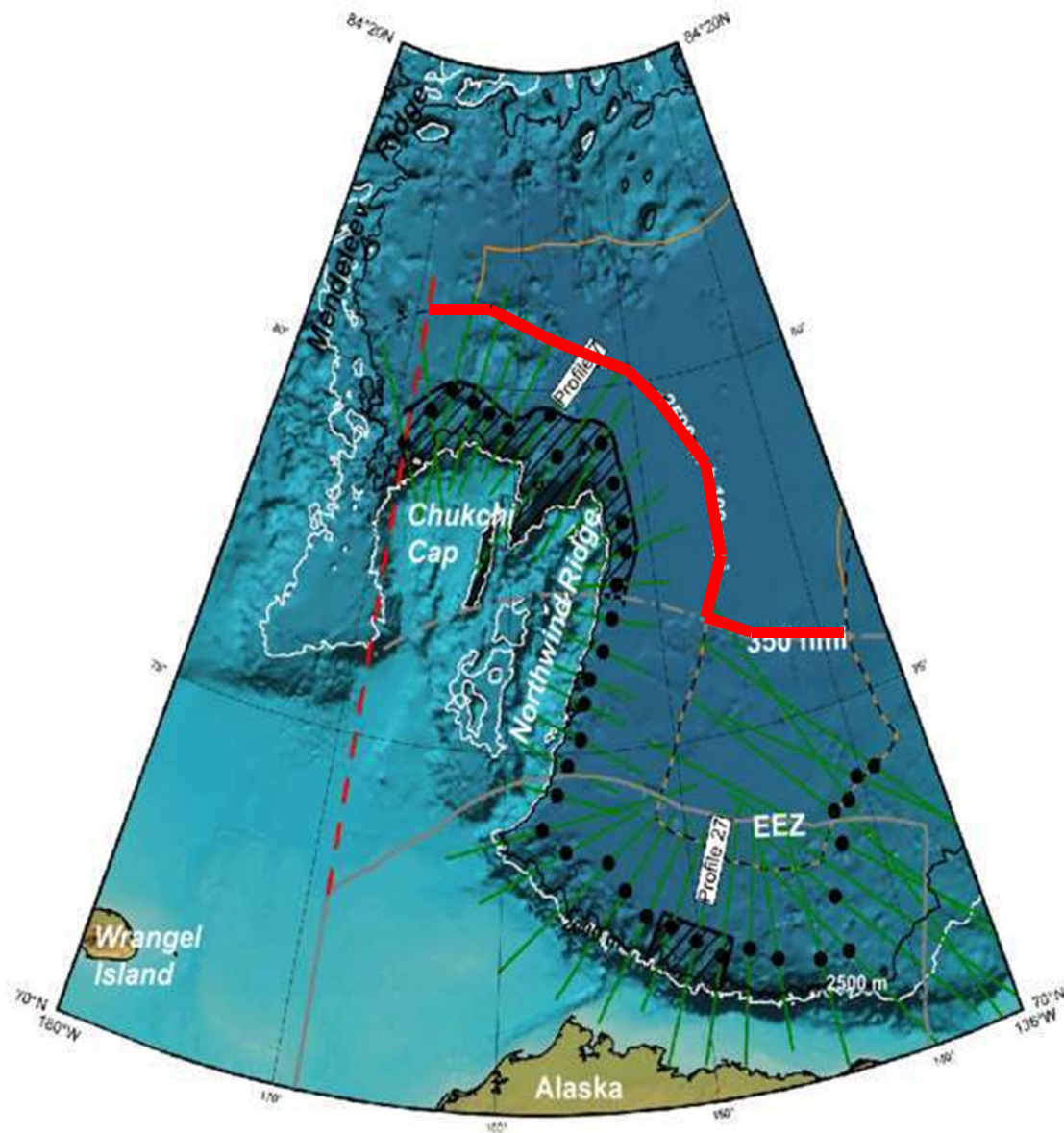
8 Regions identified where there was a potential for an extended continental shelf

For each area determine key features required



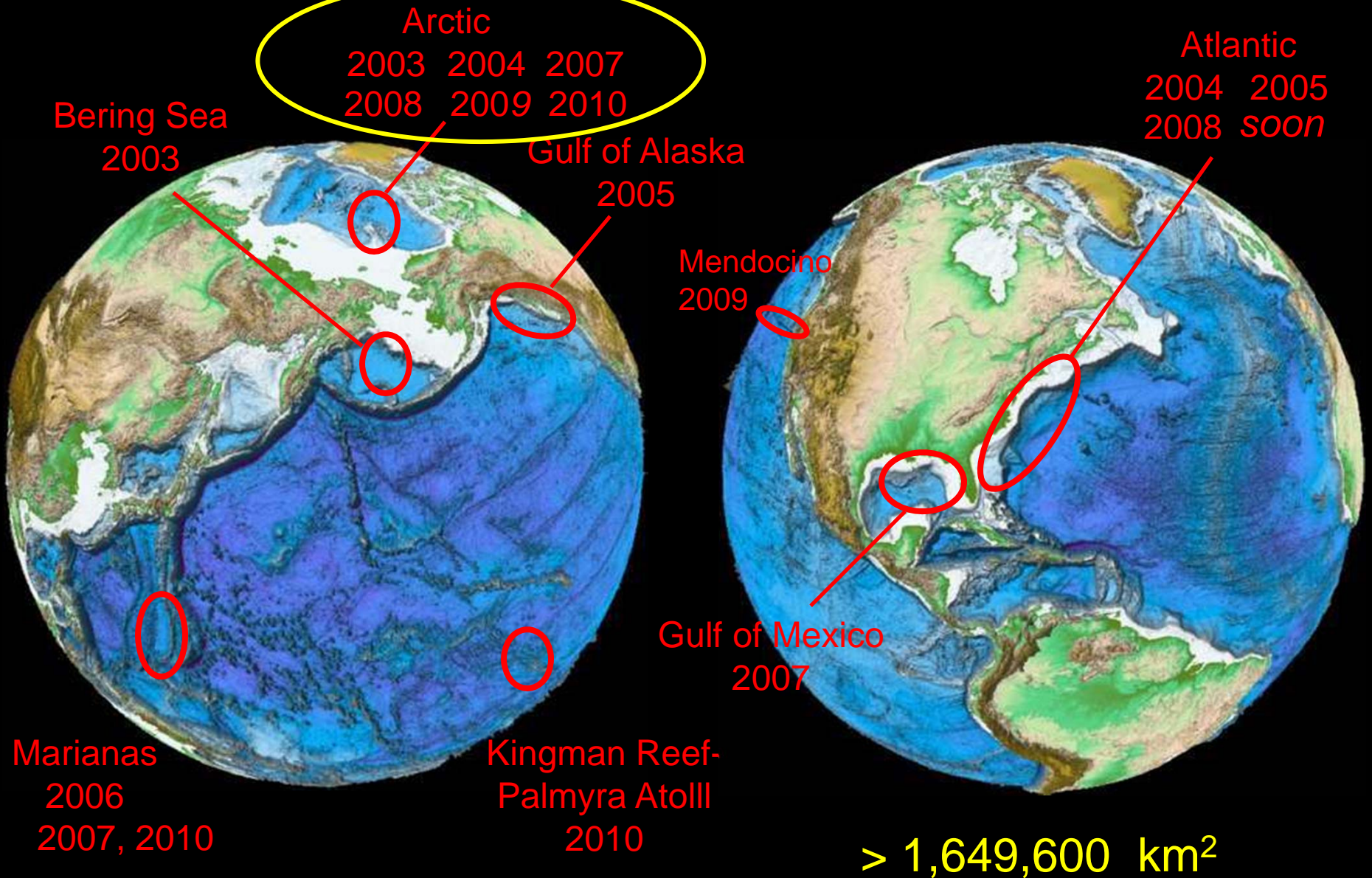
Chukchi Region and Barrow Margin





5.10B. Bathymetry from IBCAO in detailed area ARC, drawn bathymetric profiles, and possible locations of the FOS. Labeled profile is shown in figure 5.11. Note that the orange line, which represents the 2500 m + 100 nm, makes use of the 2500 m contour of the Alpha-Mendeleev Ridge as well as the Canadian shelf.

UNH CCOM-JHC U.S. Law-of-the-Sea Bathymetric Mapping to Date



TIME

ARCTIC LANDGRAB

As rising temperatures melt the polar ice cap, five countries race to map their claims to a new energy frontier. The stakes are huge. Nearly a quarter of the world's undiscovered oil and gas may lie beneath the seabed of this vast wilderness.


NATIONAL
GEOGRAPHIC™



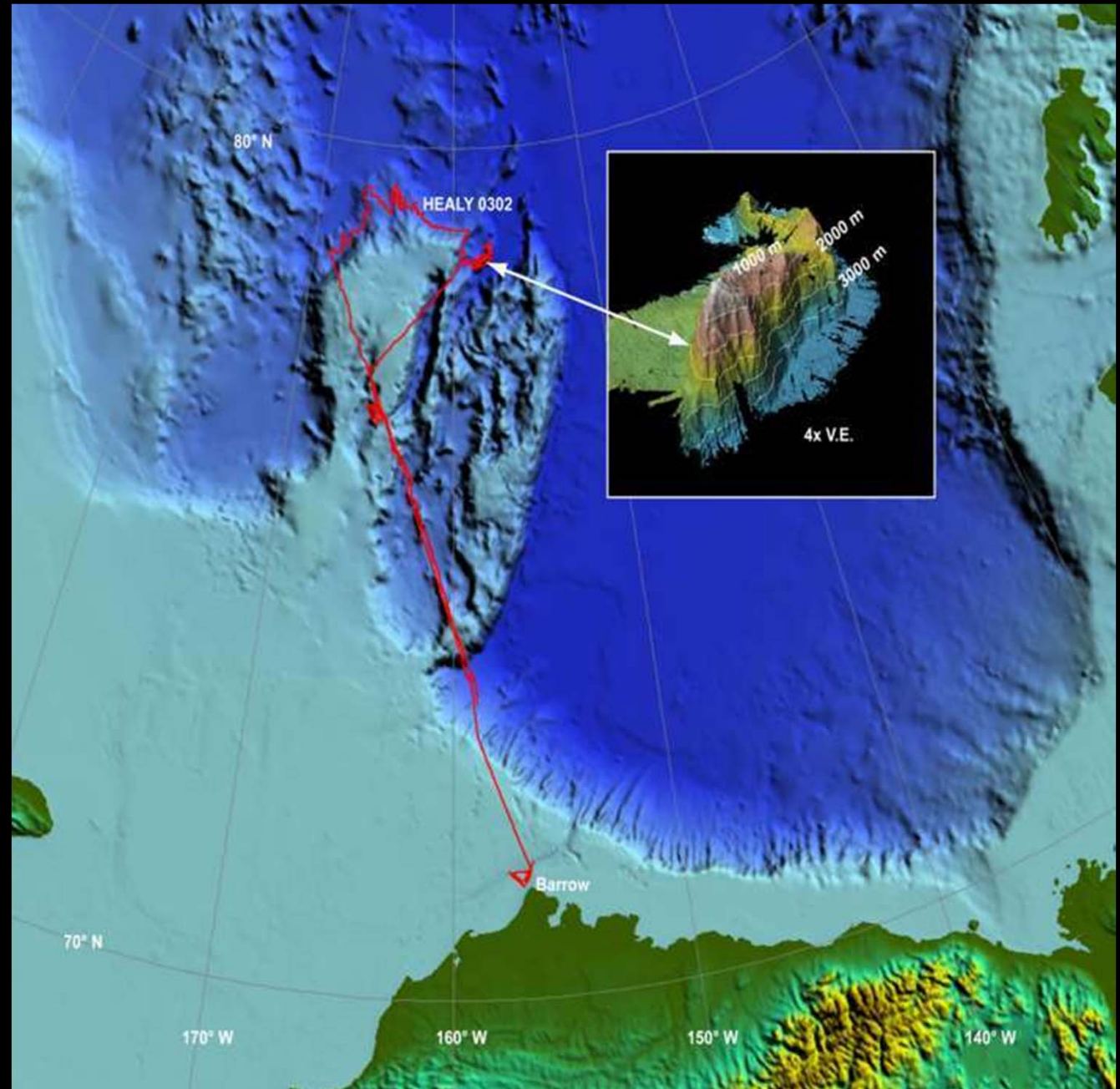
TIME

May 7, 2009: Smokin' Pole - The Fight for Arctic Riches

Video paused...



Healy 03-02
~3000 km of
multibeam
sonar
bathymetry
1-11 Sept 03
8/10 ice



Annual Sea Ice Minimum

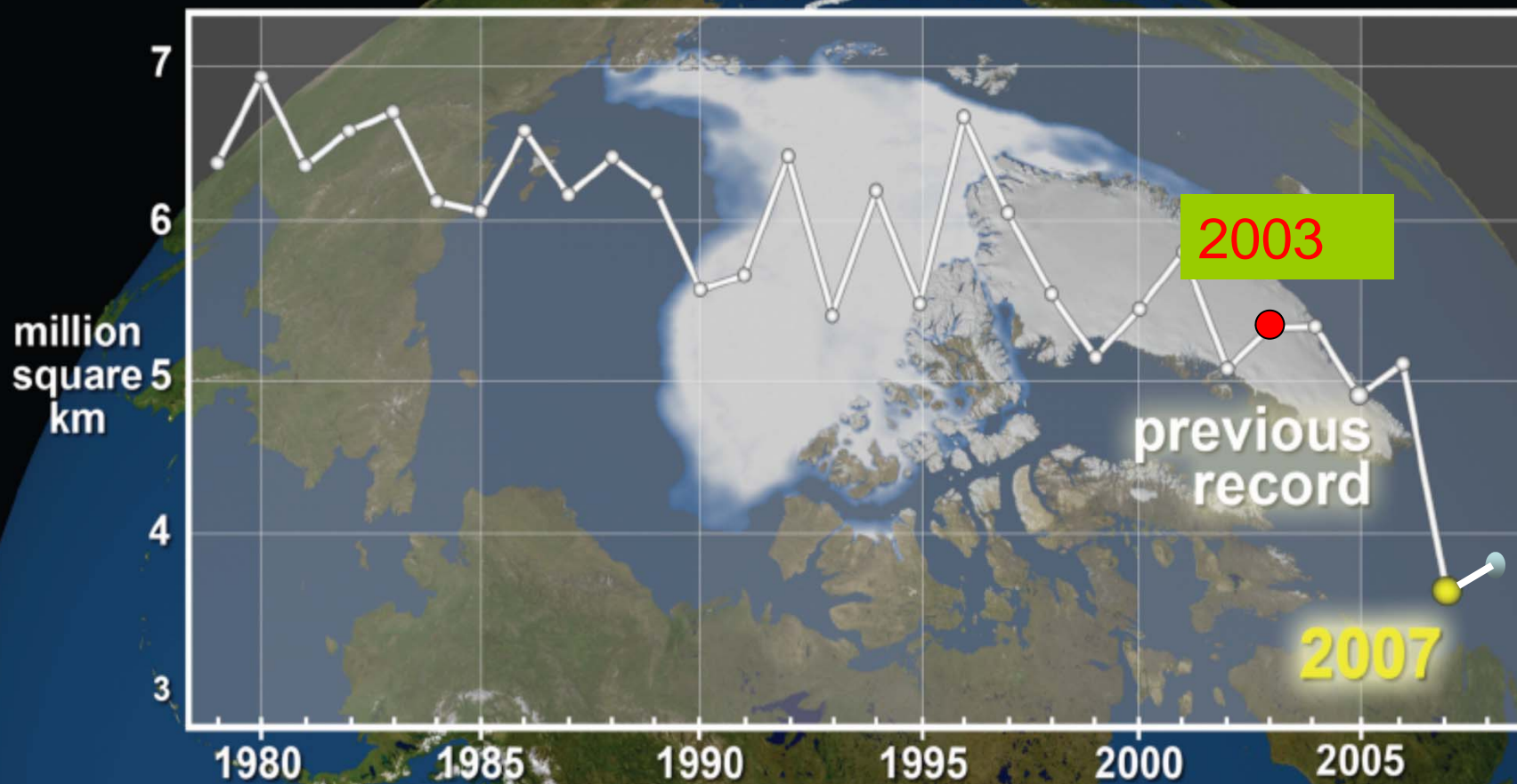
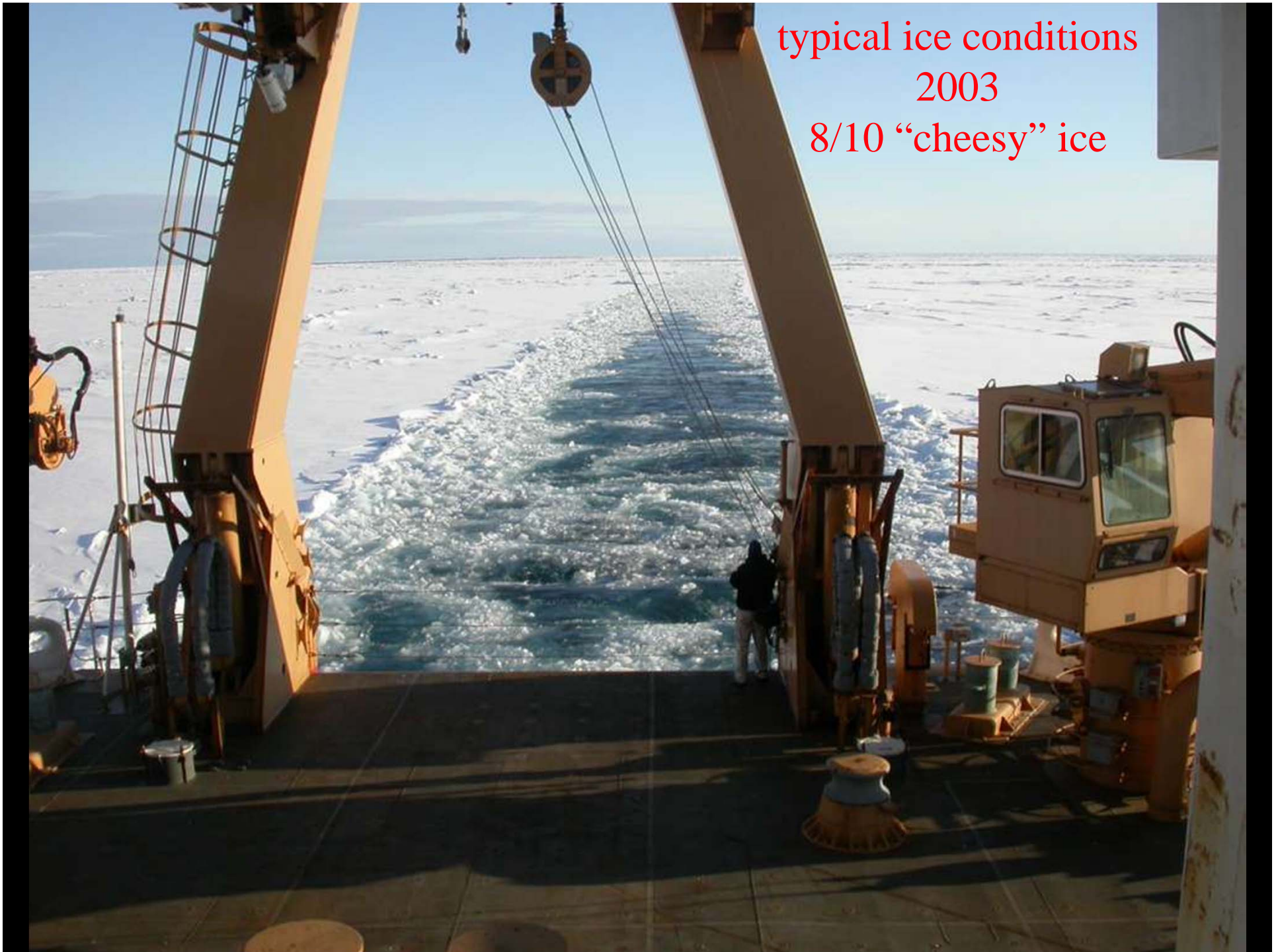
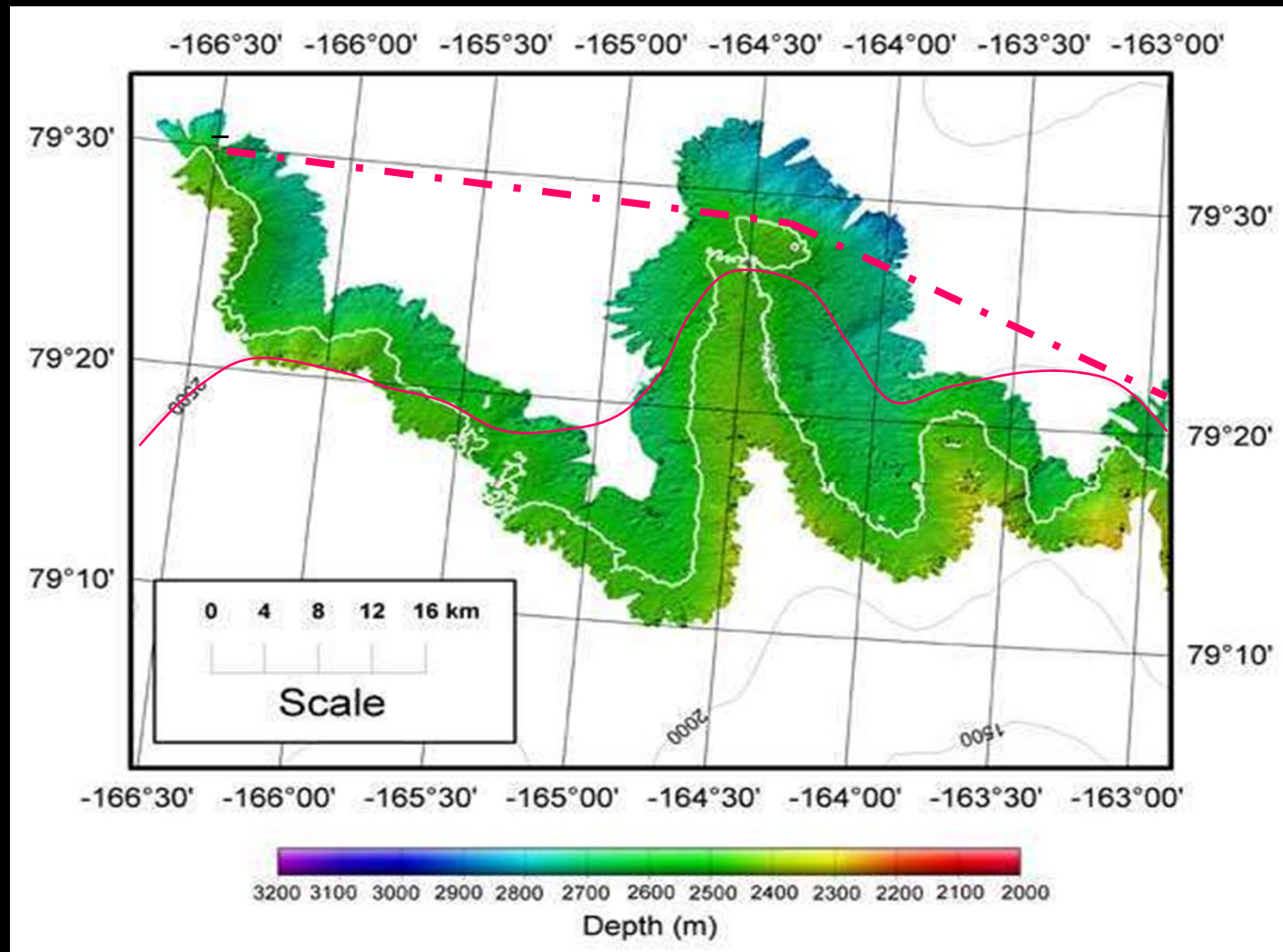


Image Source: NASA (svs.gsfc.nasa.gov)

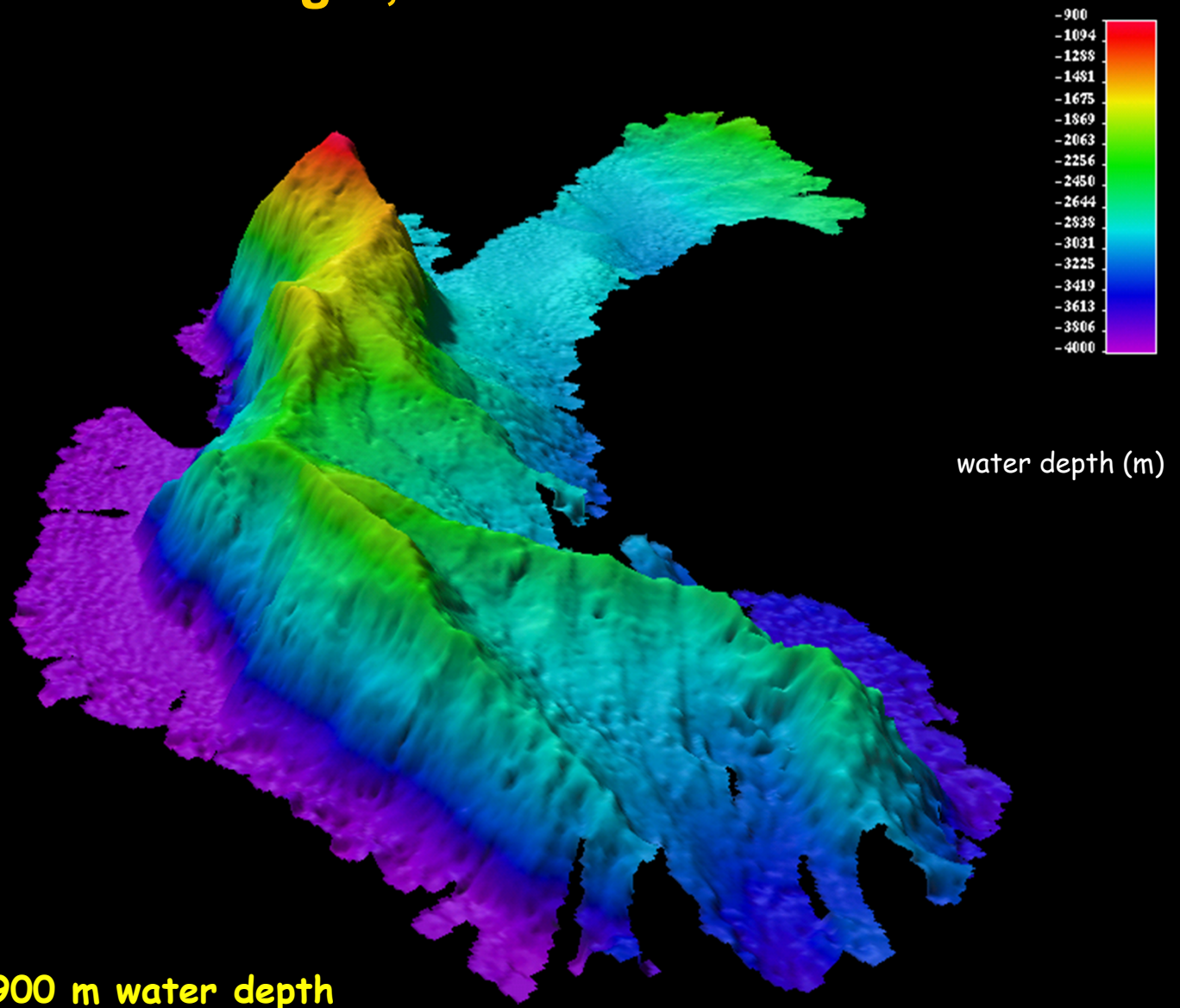
typical ice conditions
2003
8/10 “cheesy” ice



Redefinition of the 2500 m contour



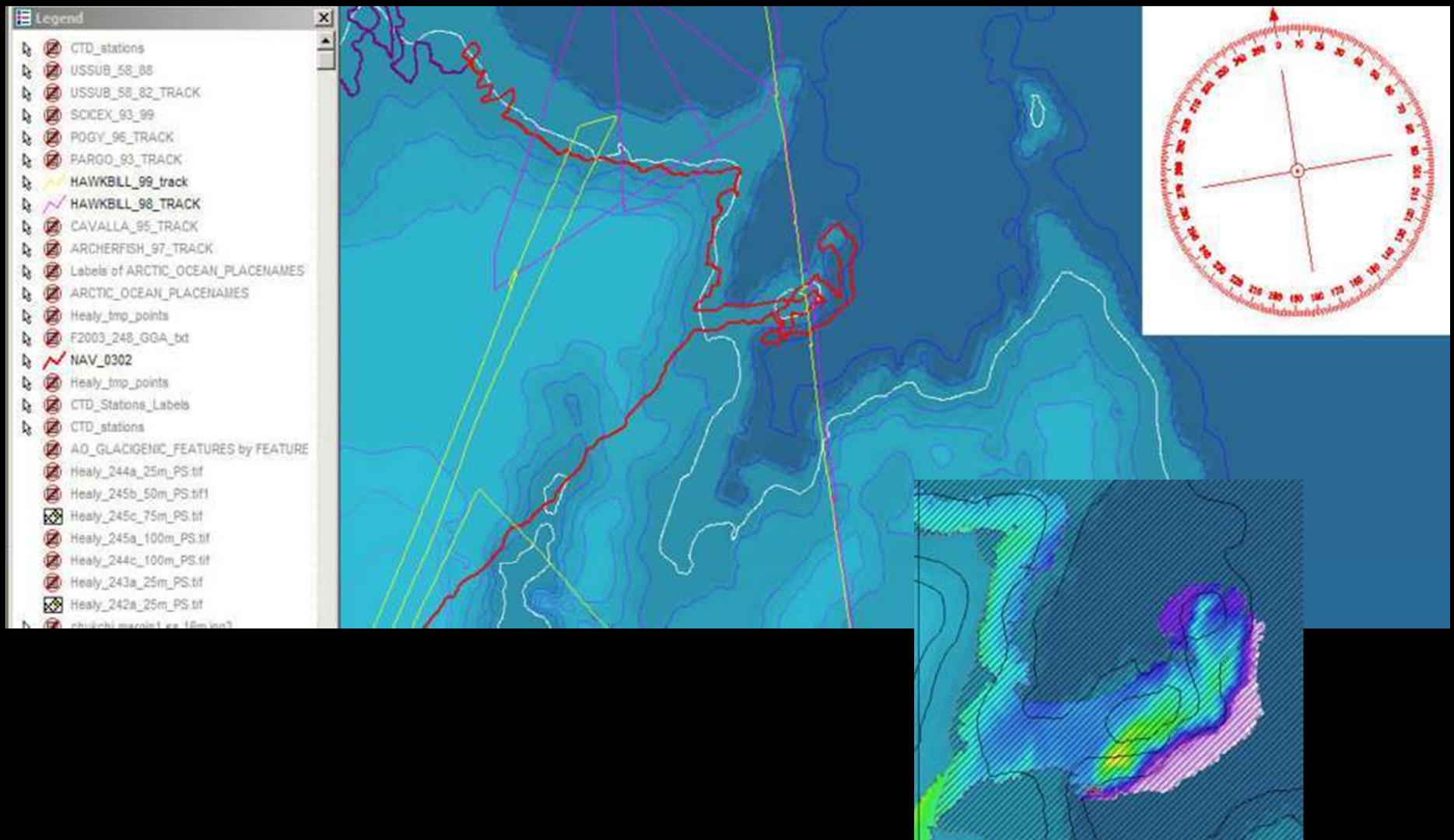
Healy Seamount looking S, ve=6x



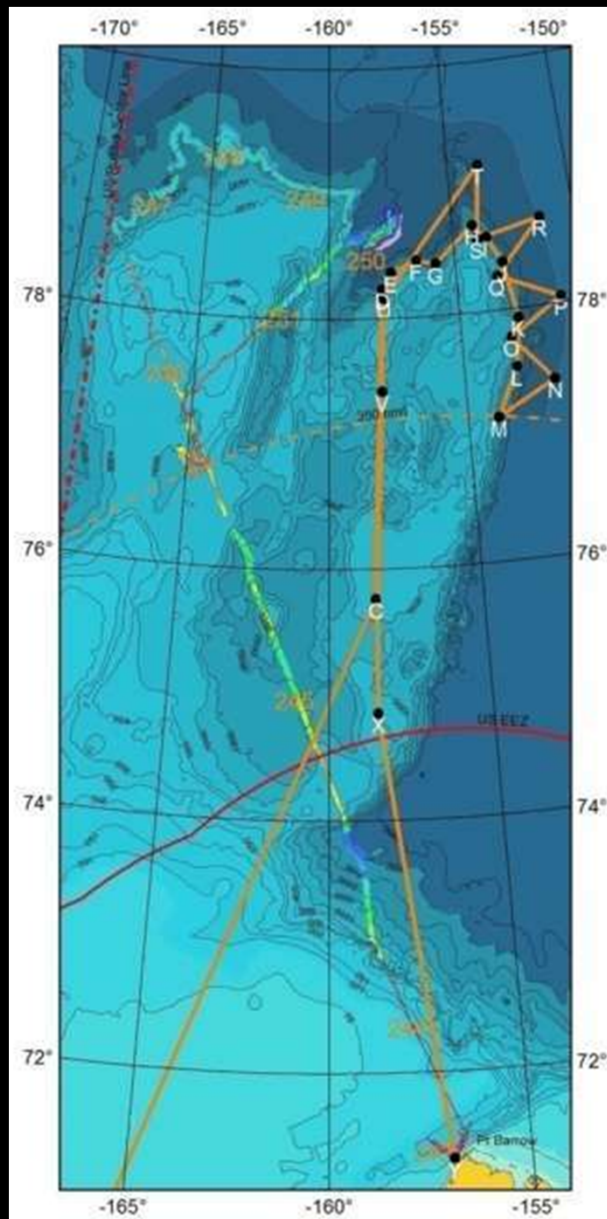
3100 m high, summit at 900 m water depth

45 km long x 15 km wide

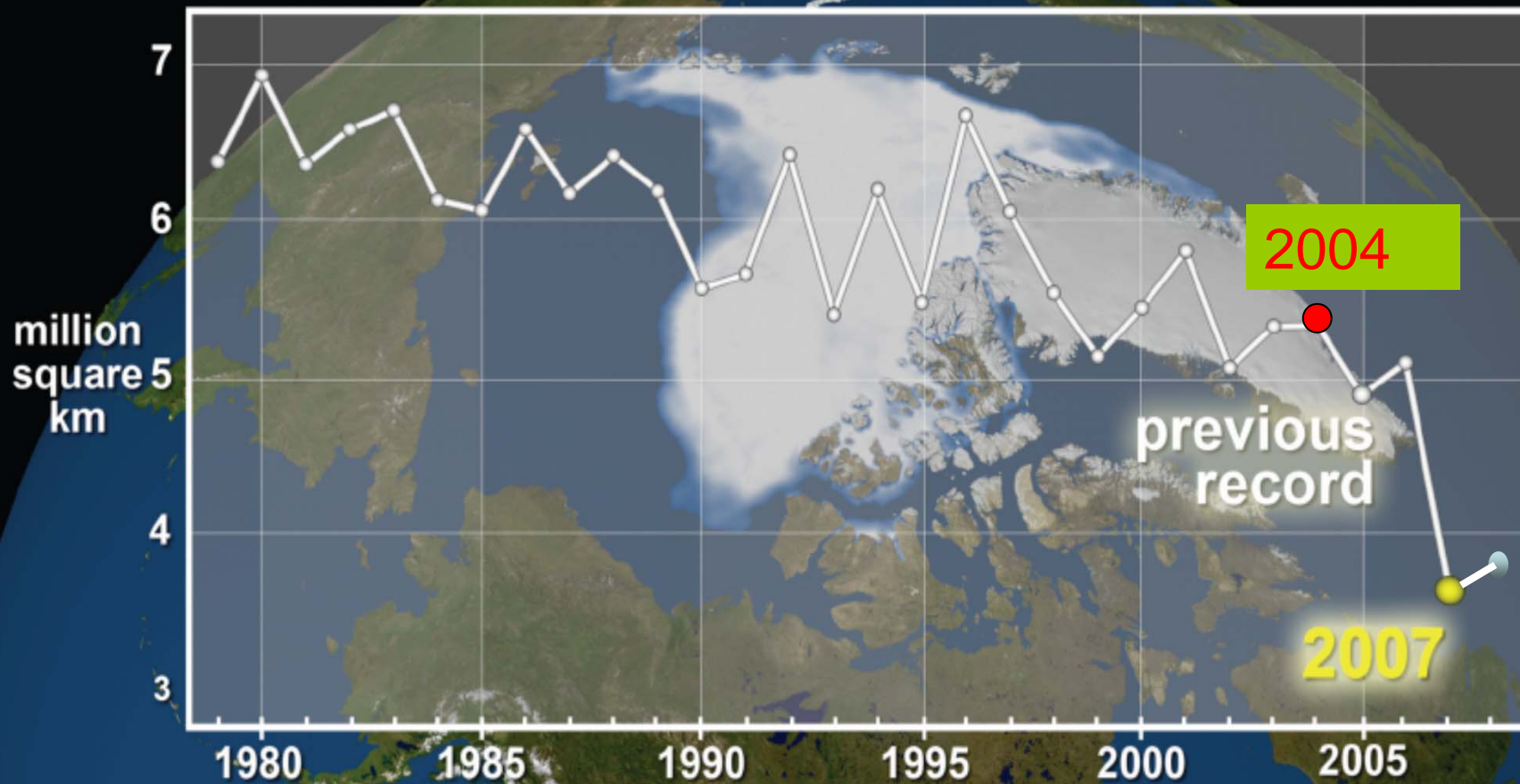
Healy Seamount Survey

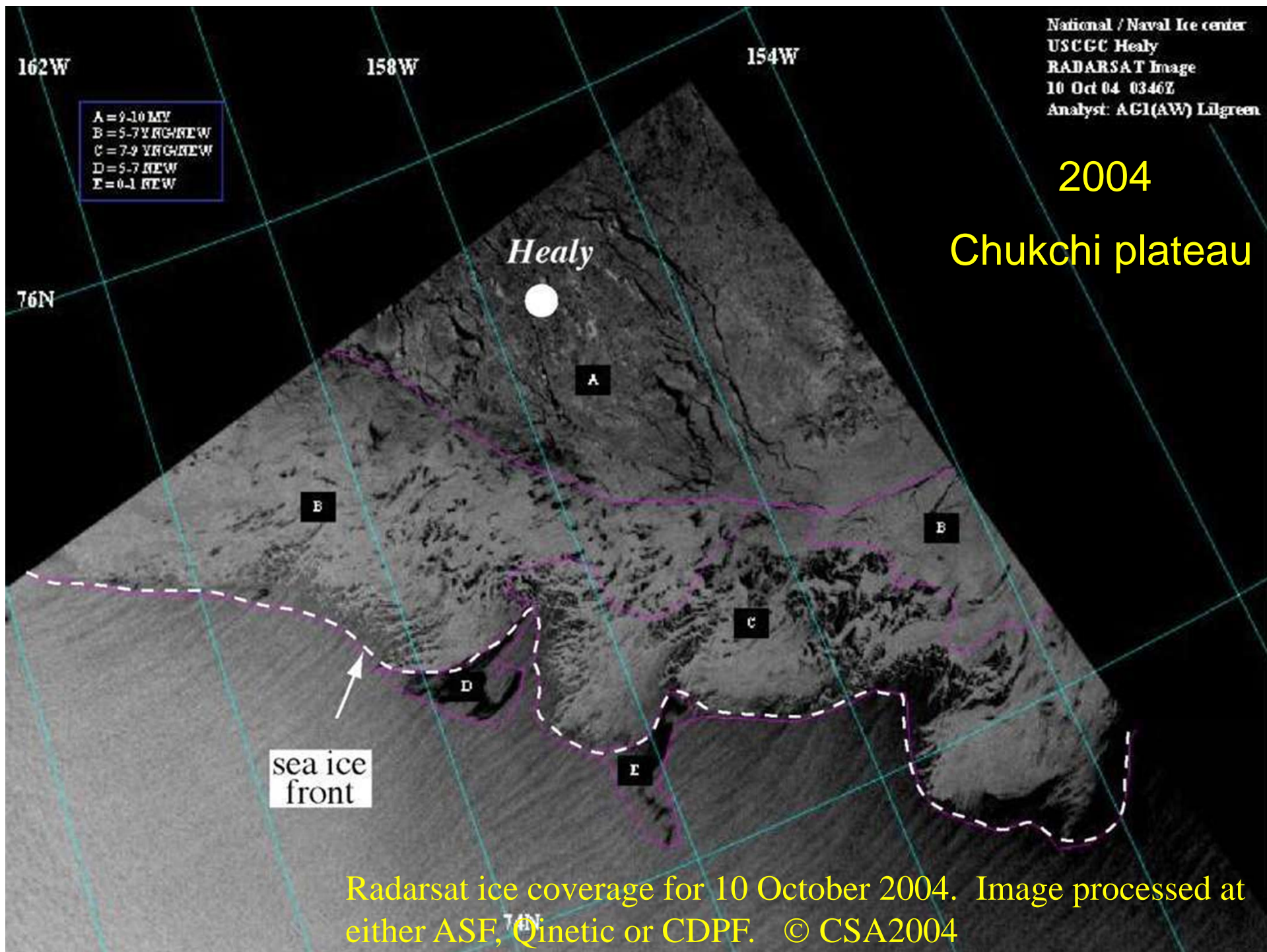


HEALY 2004 - Plan



Annual Sea Ice Minimum





How do we map in this?



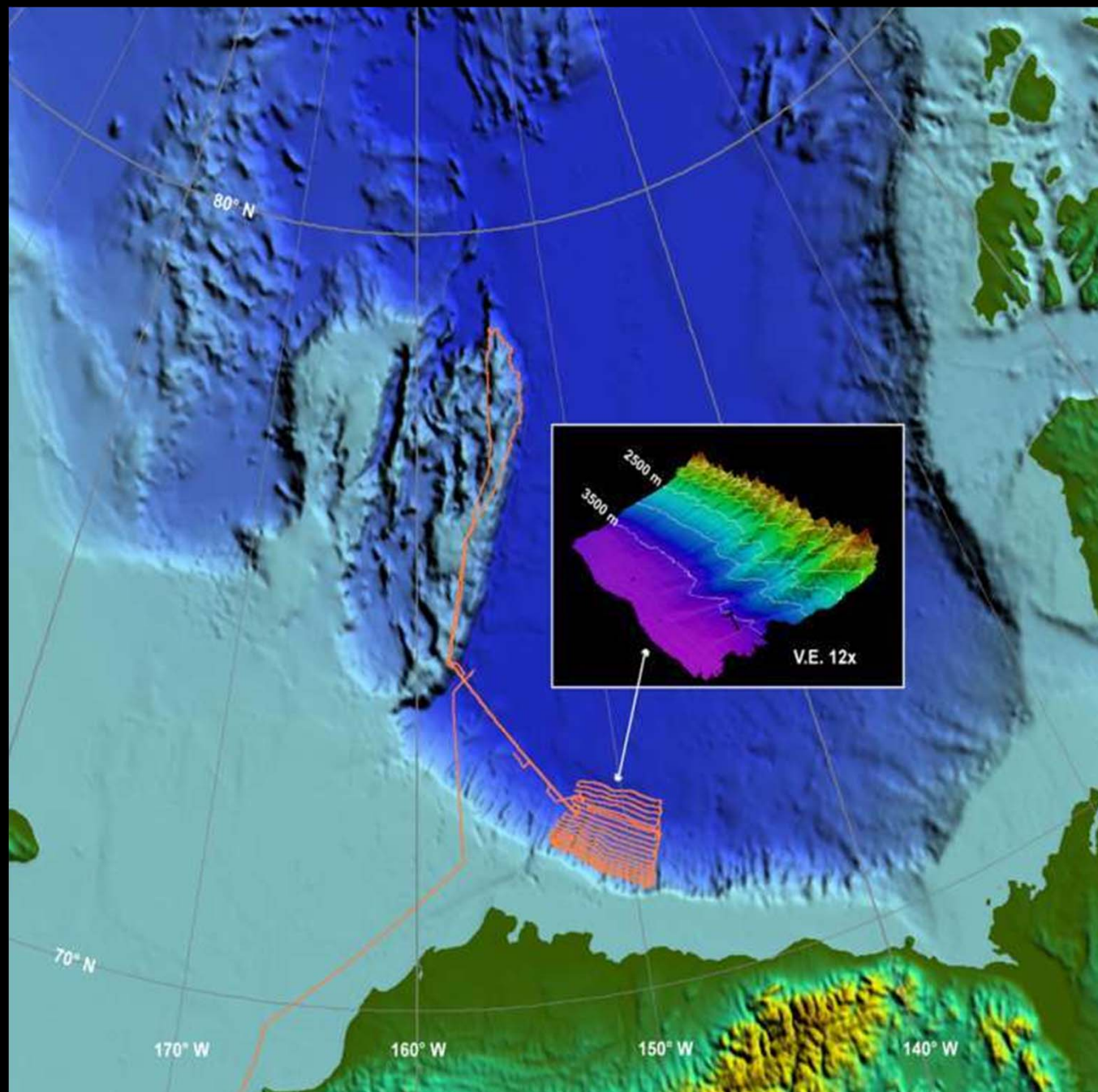
Photo from M. Jakobsson

Healy 04-05
TRACK

6-26 Oct. 2004

6700 line km

“Ratchet” Surveying
and
Open Water Surveying



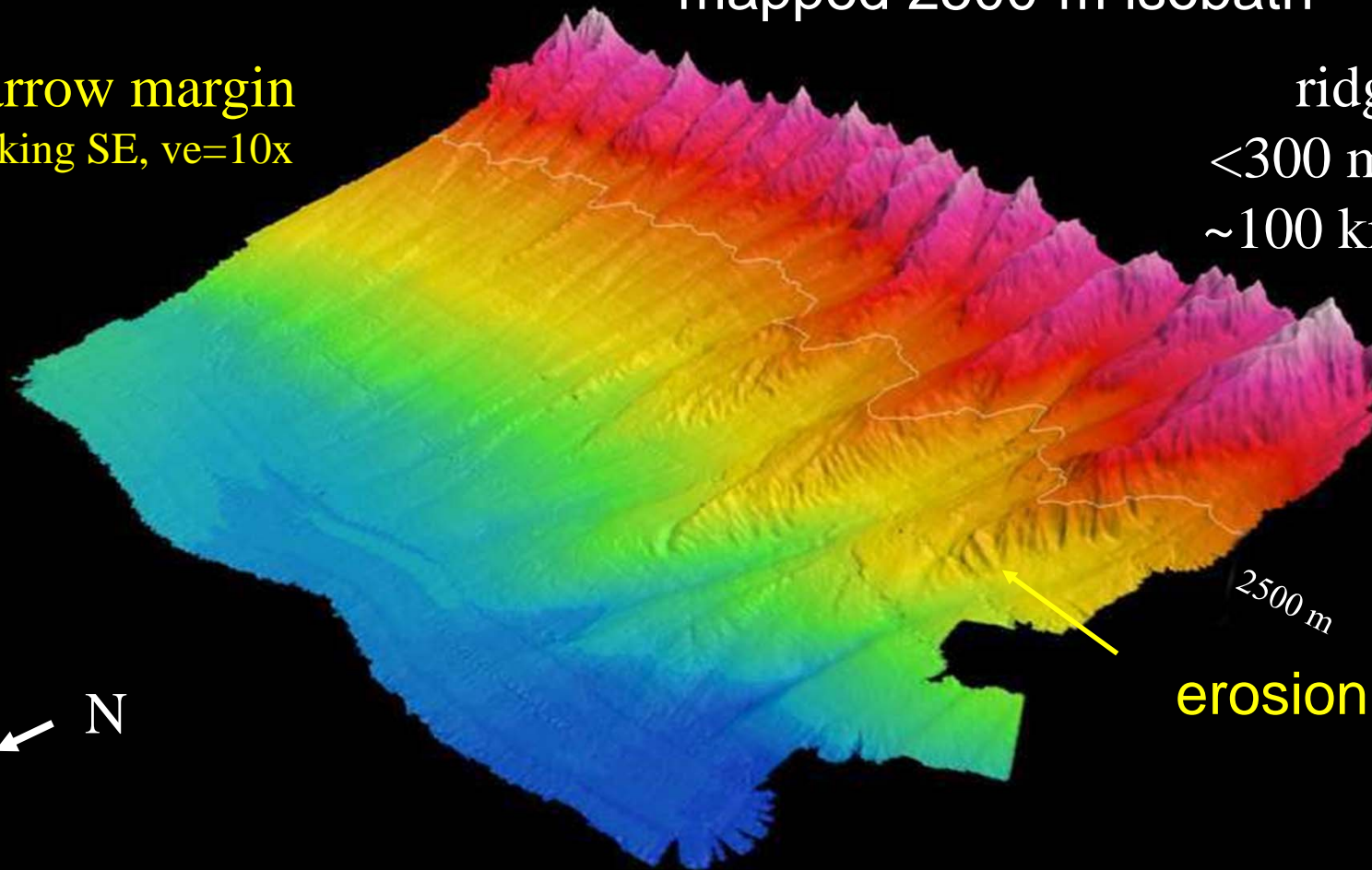
mapped 2500-m isobath

Barrow margin
looking SE, ve=10x

ridges
<300 m high,
~100 km long

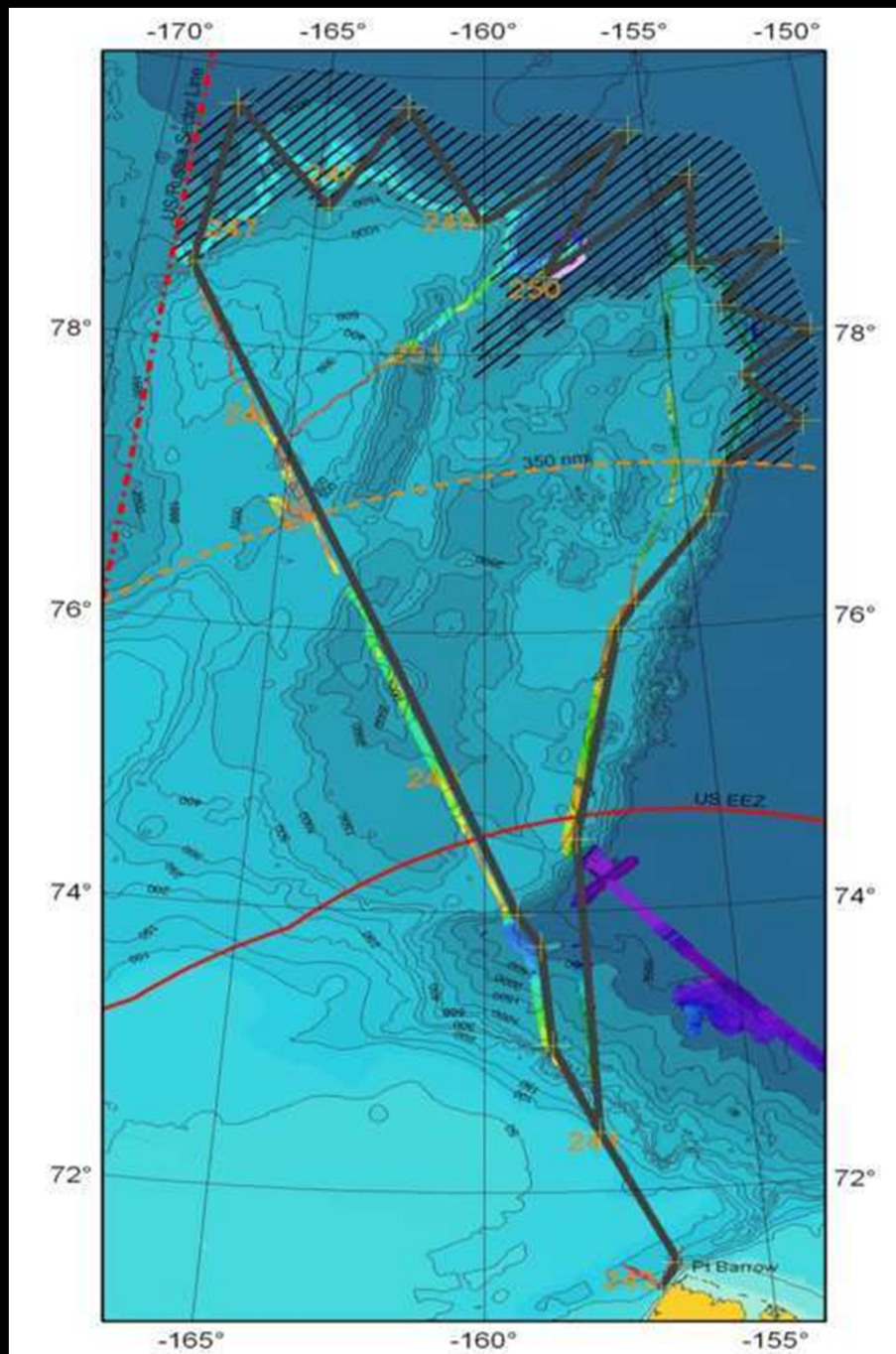
↖ N

2500 m
erosion



Healy 07-03
Plan

Depart Barrow:
17 Aug. 07
Return Barrow
15 Sept. 07



Annual Sea Ice Minimum

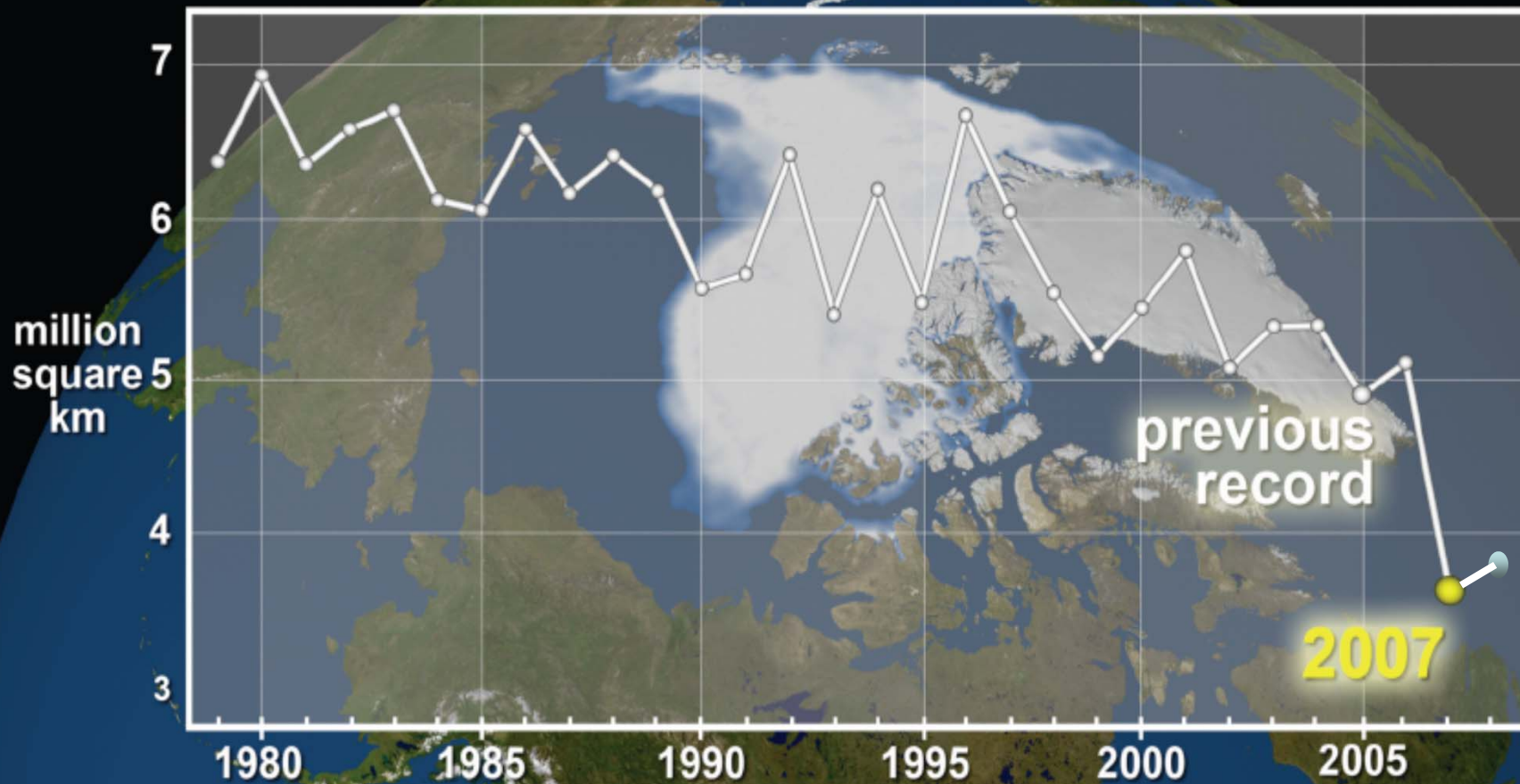


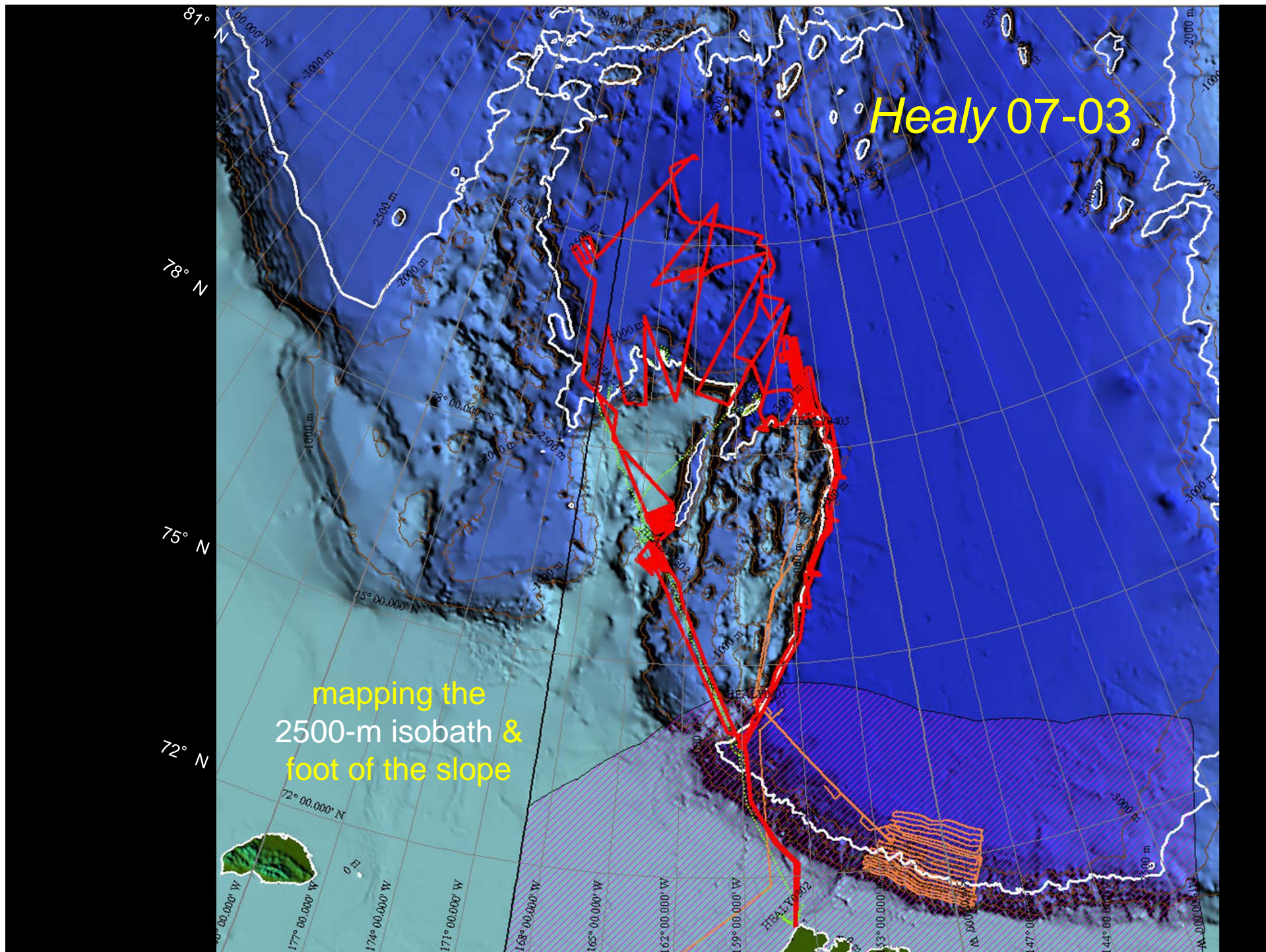
Image Source: NASA (svs.gsfc.nasa.gov)



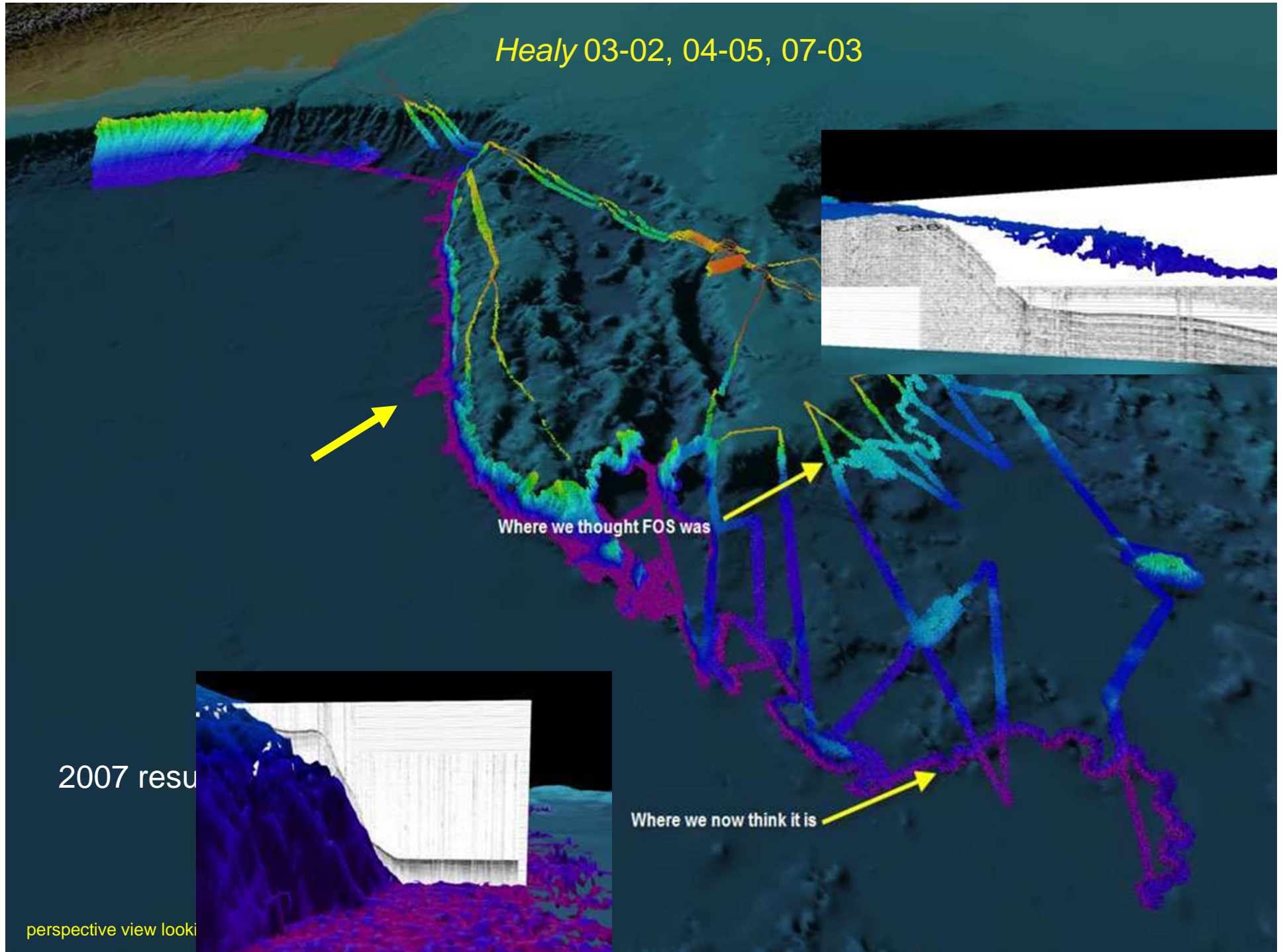


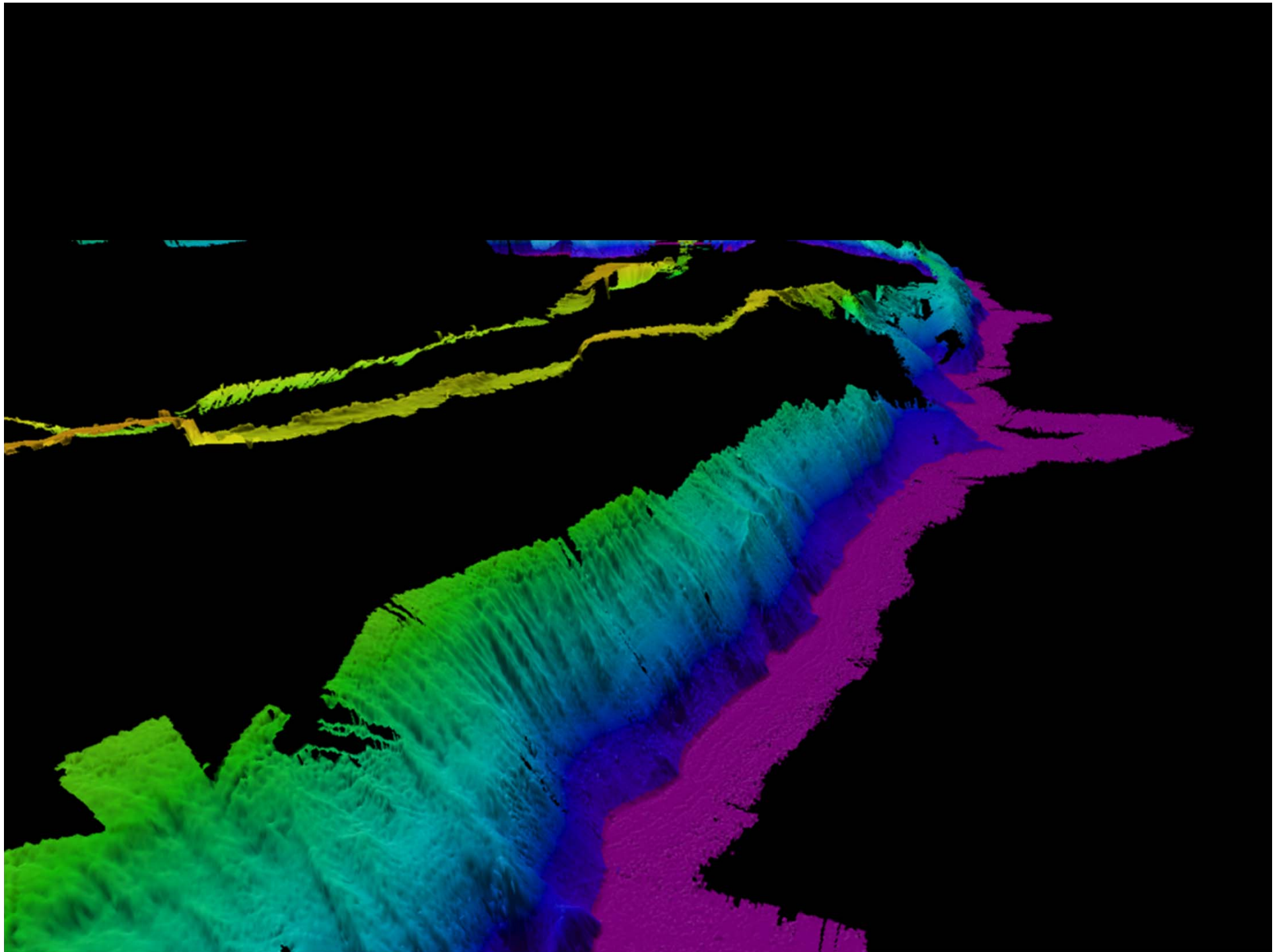
Healy 07-03

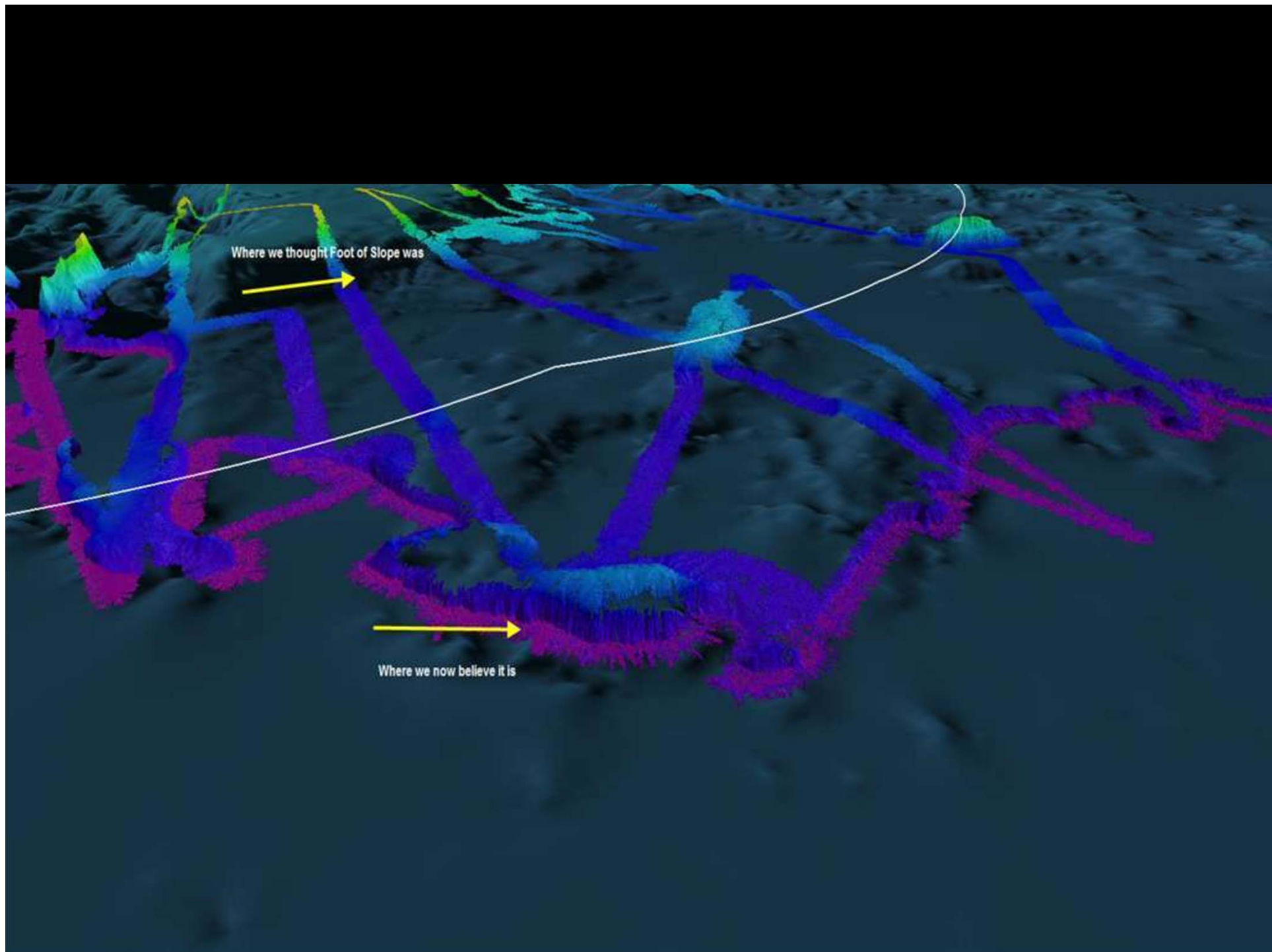
mapping the
2500-m isobath &
foot of the slope



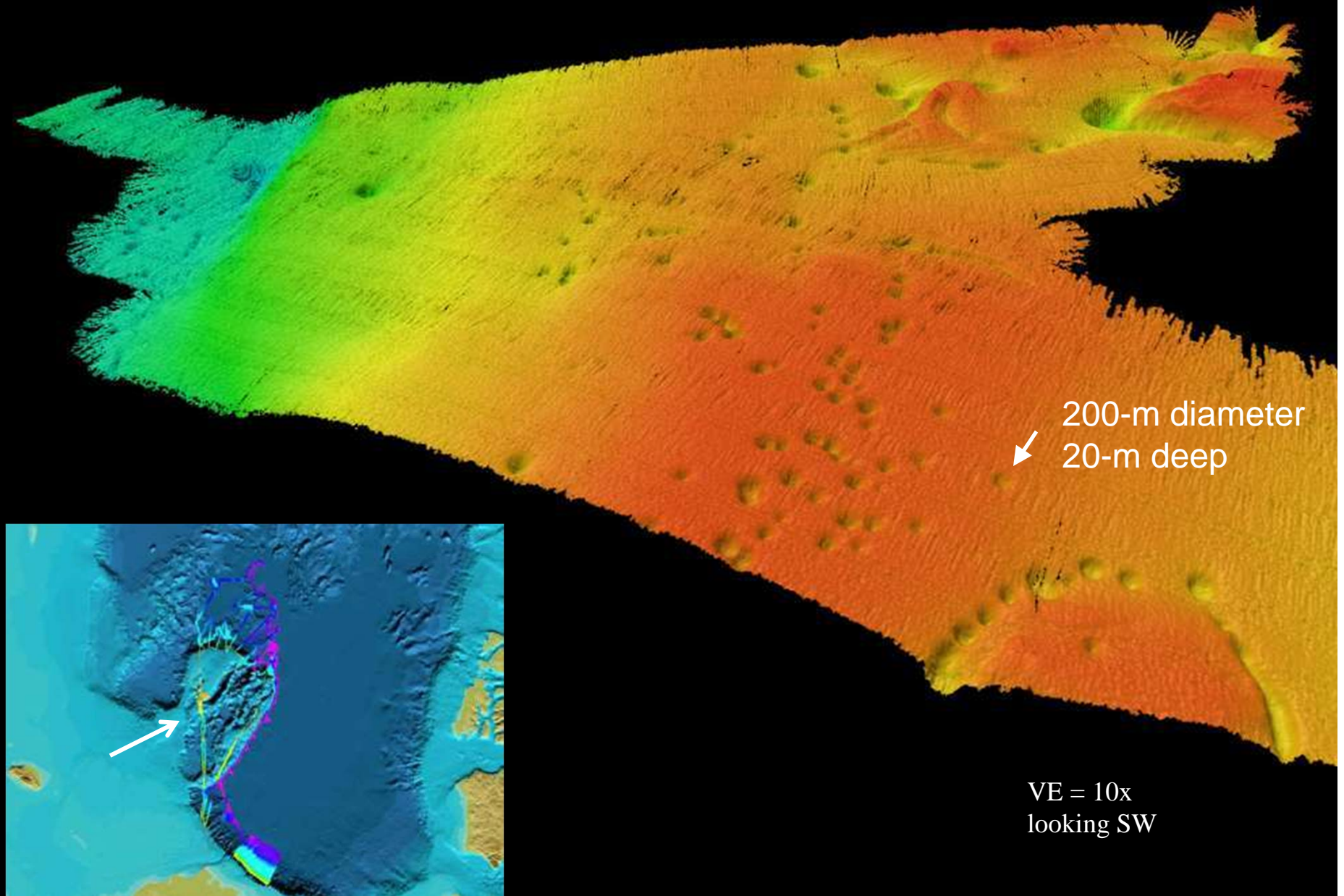
Healy 03-02, 04-05, 07-03

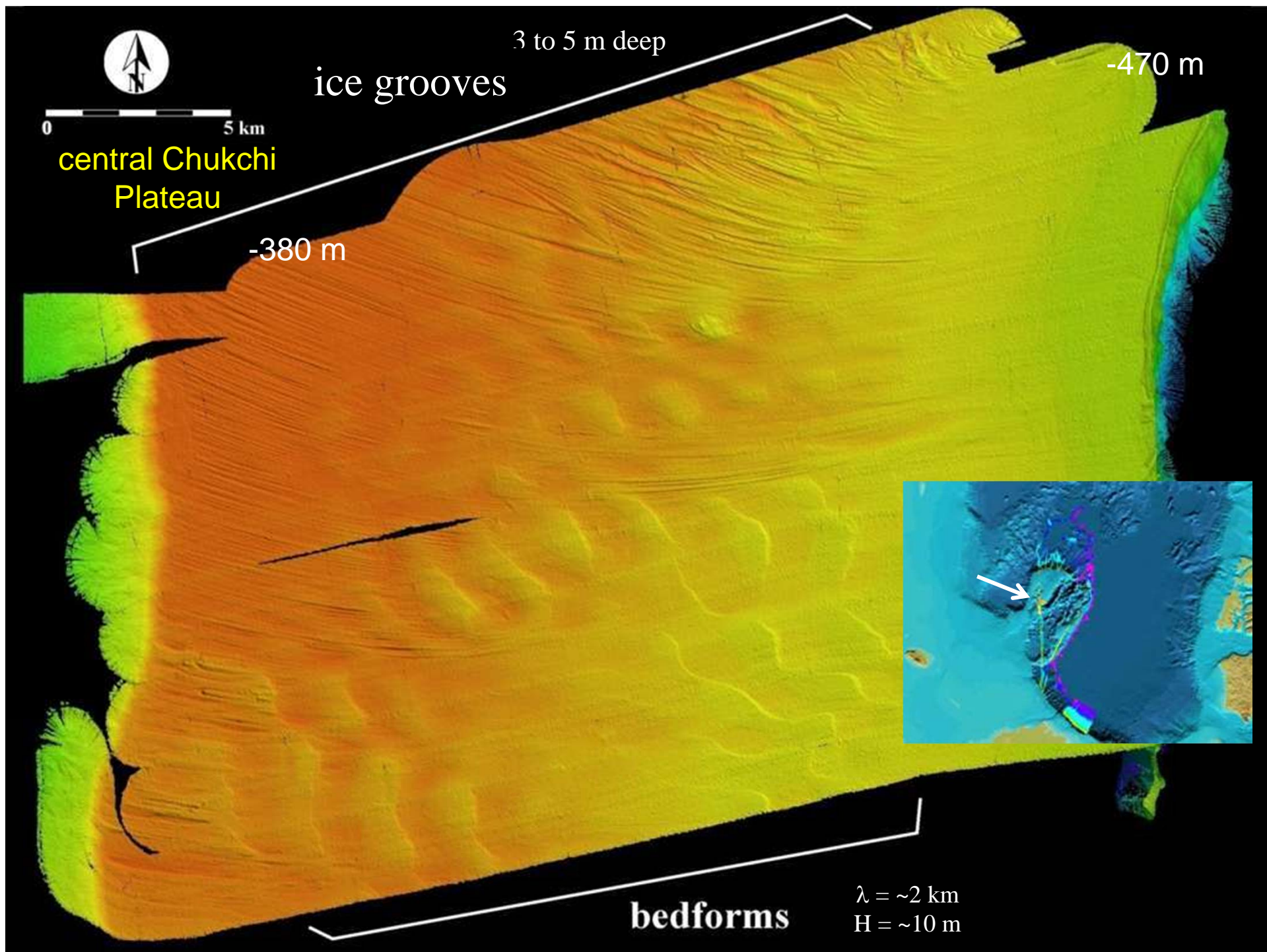






central Chukchi Plateau pockmarks





Annual Sea Ice Minimum

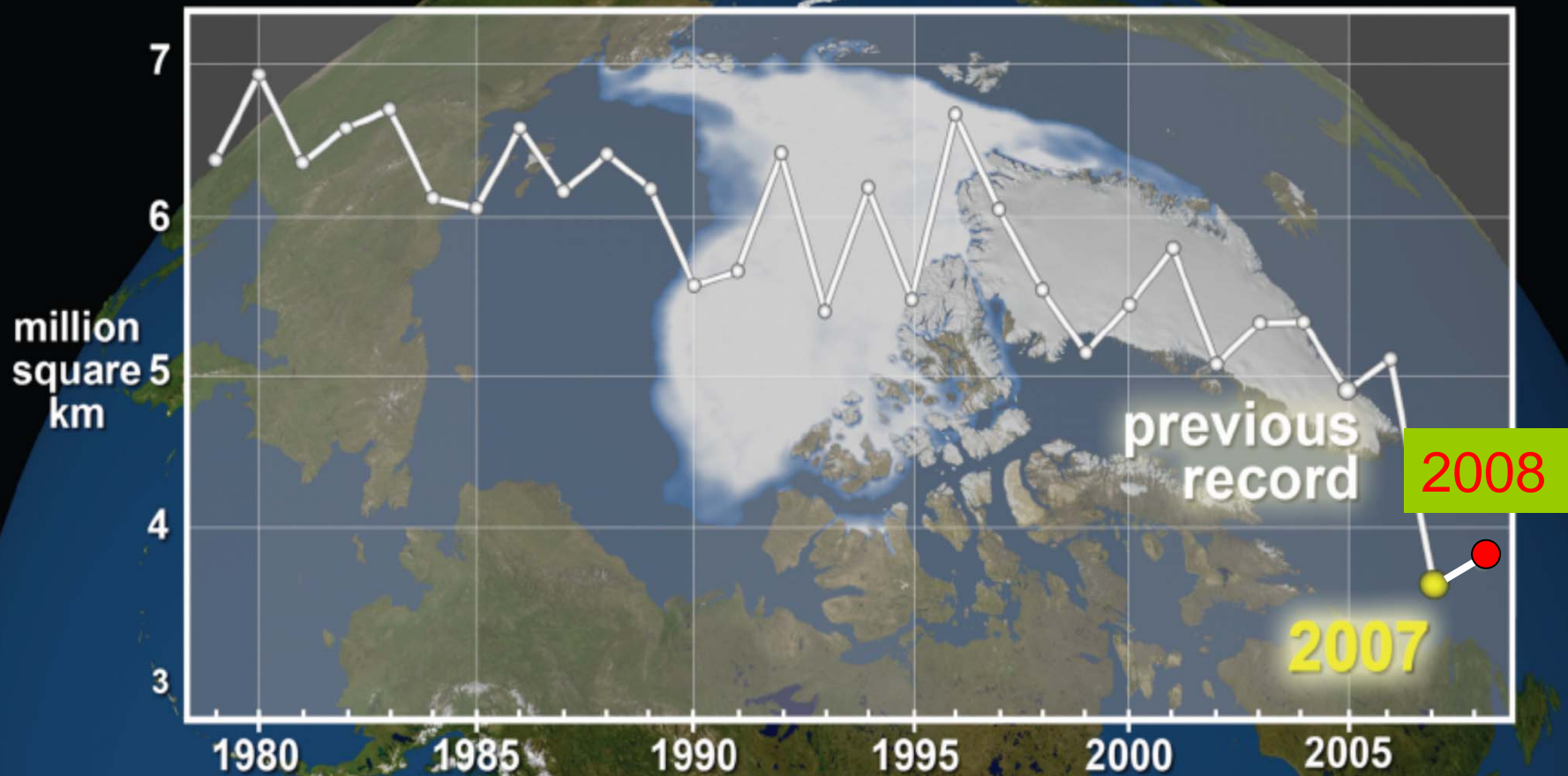
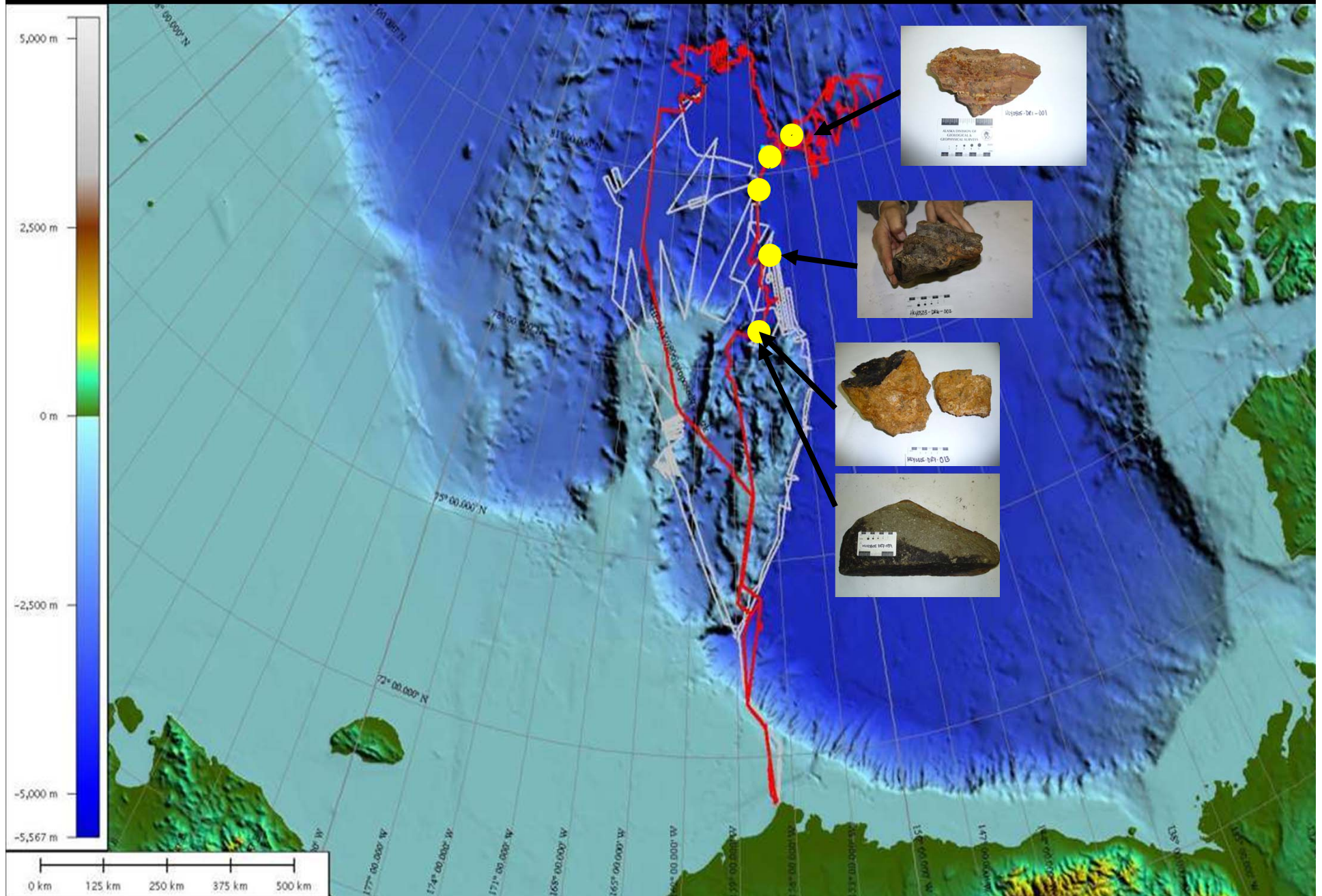


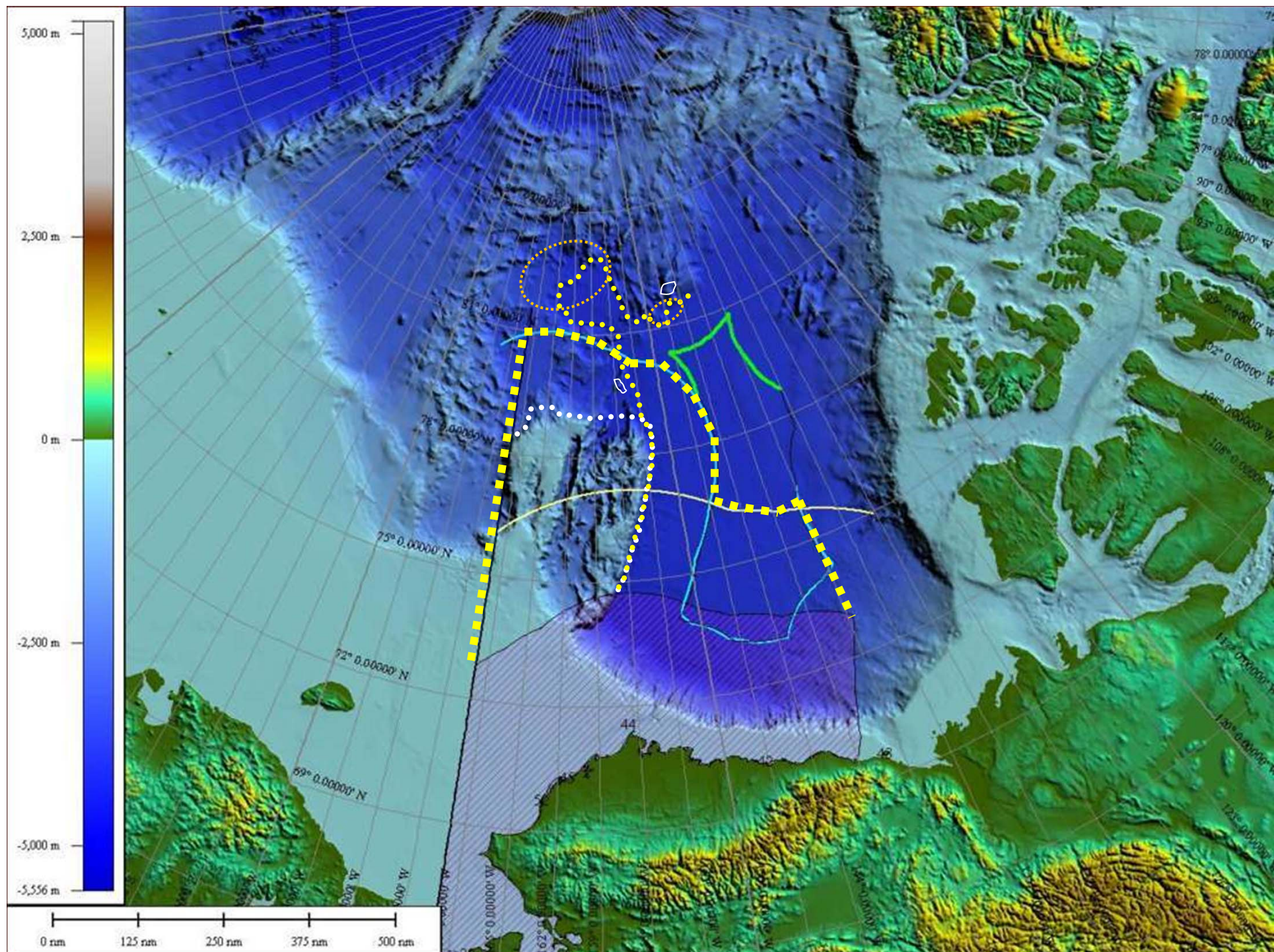
Figure 1 is a bathymetric map of the study area in the western North Pacific. The map displays depth contours ranging from 5,000 m to -5,567 m. A red line indicates the survey track, and a white line outlines the continental shelf. The map includes latitude and longitude coordinates and a scale bar from 0 to 500 km.

DREDGING IN THE ICE



Healy 08-05 – SHIPTRACK AND DREDGE SITES





Annual Sea Ice Minimum

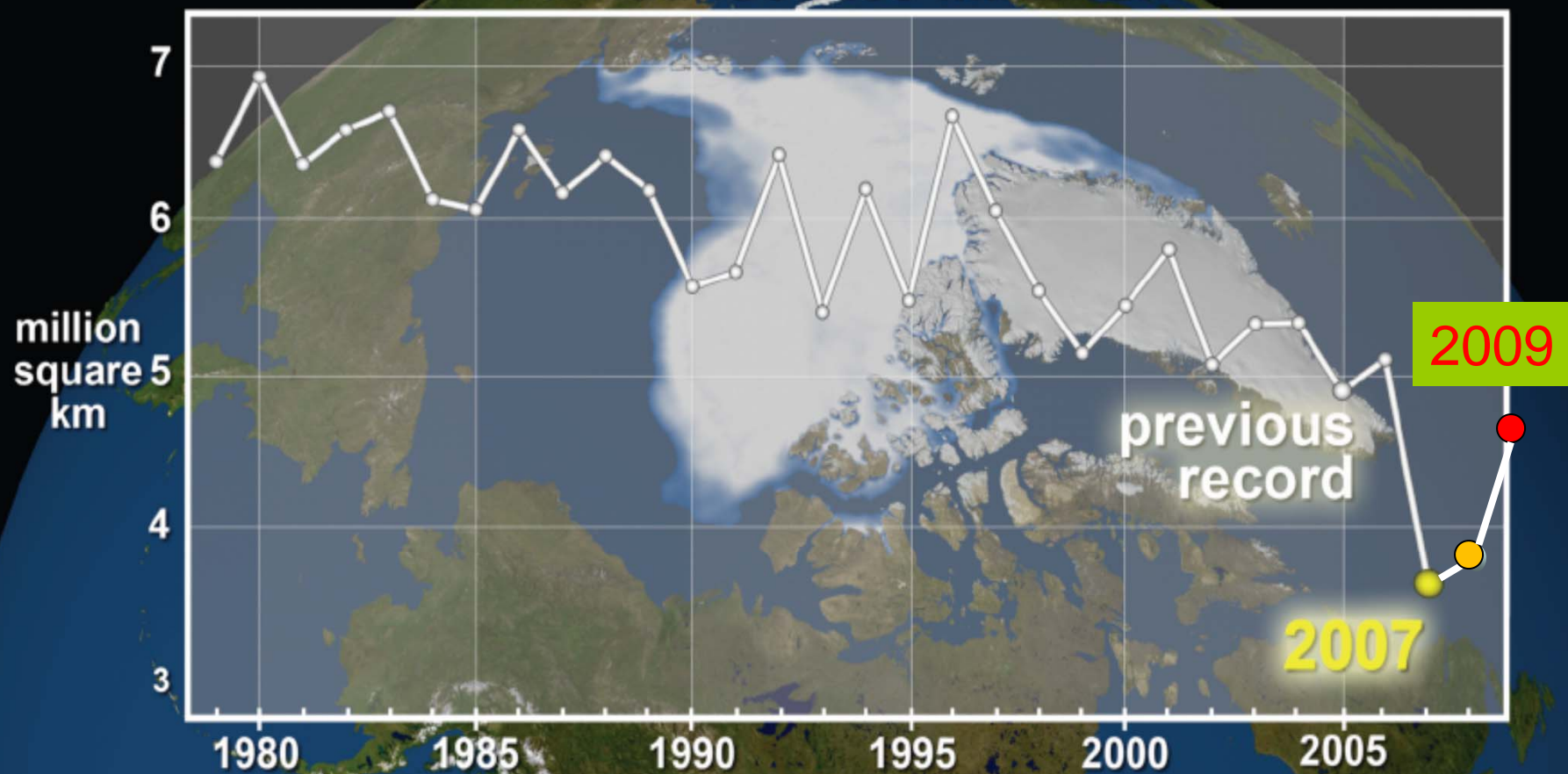


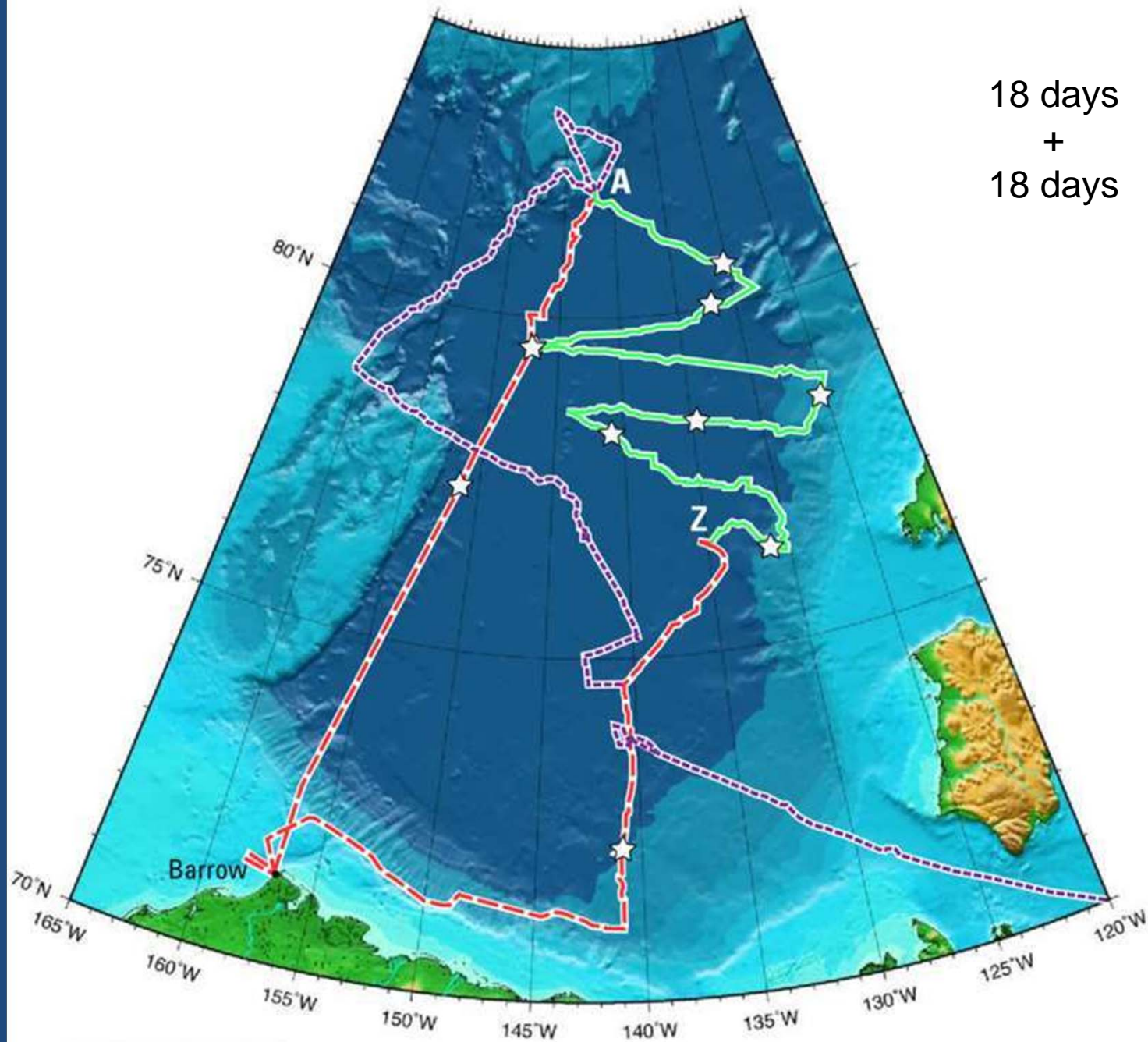
Image Source: NASA (svs.gsfc.nasa.gov)

Healy 08-06 and 09-05 – JOINT CANADIAN/U.S. PROGRAM – FOCUS ON SEISMIC

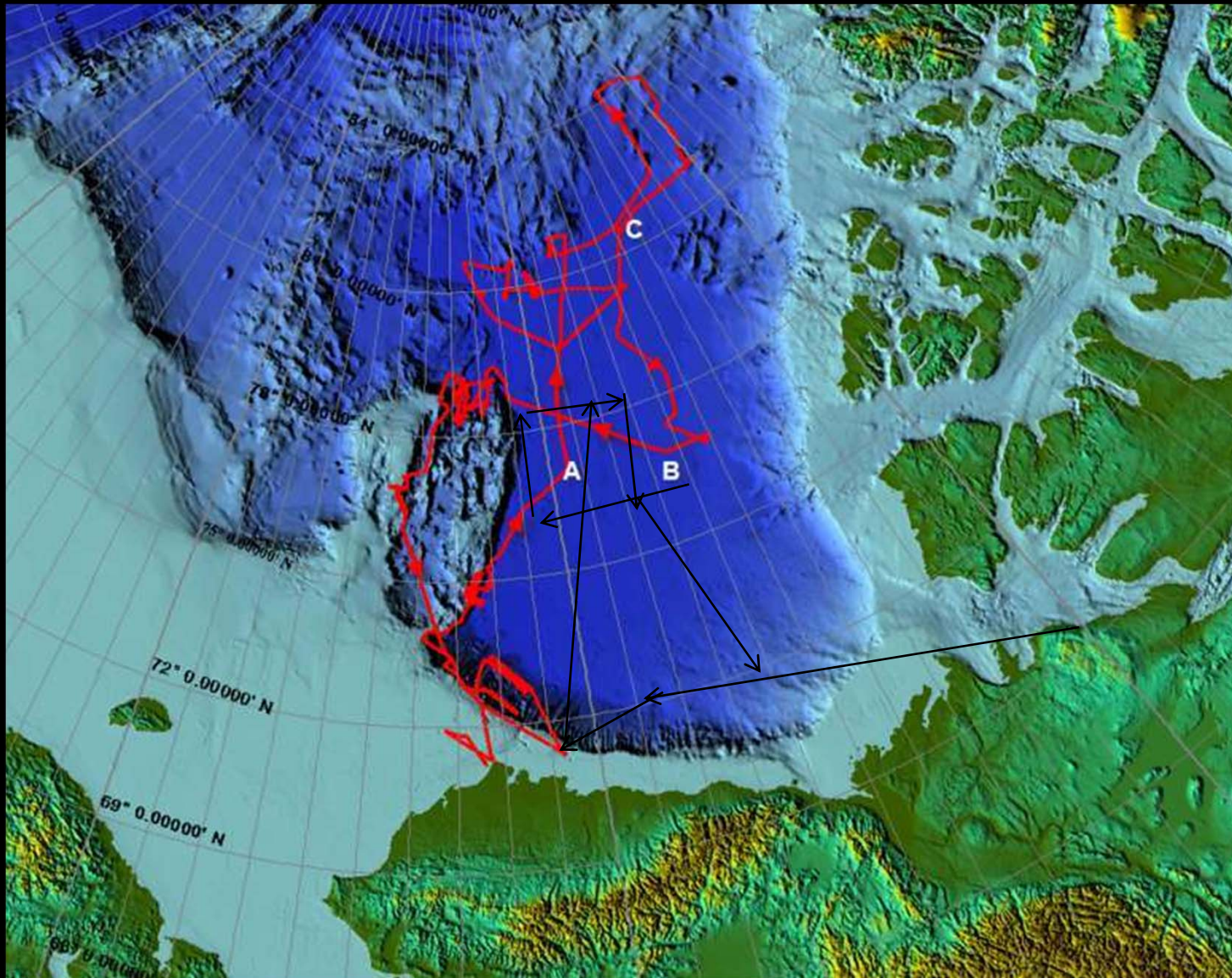


HLY0806 09/05/08 - 10/01/08

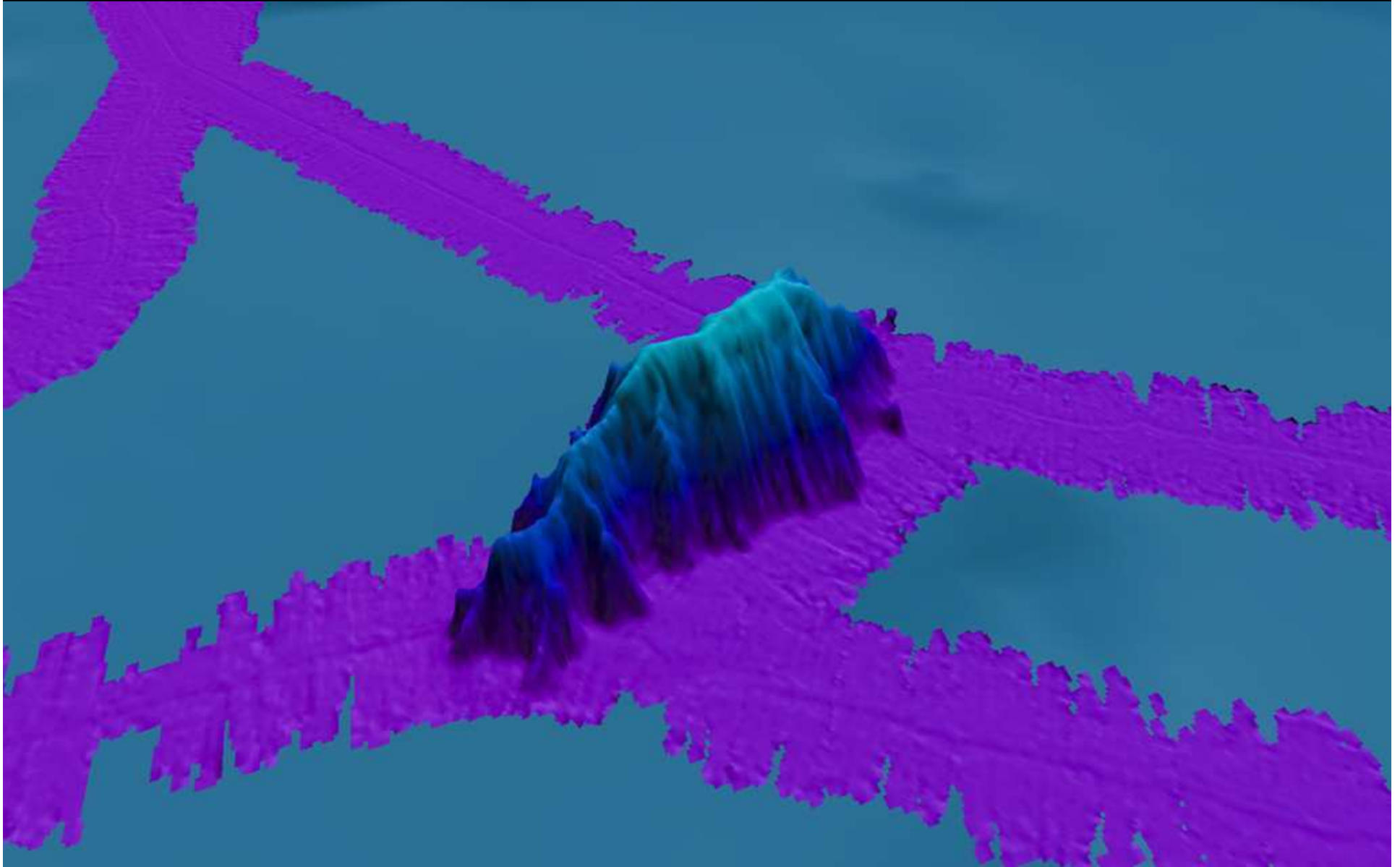
18 days
+
18 days



Healy 09-05



New Seamount: Savaqatigiit Seamount



Annual Sea Ice Minimum

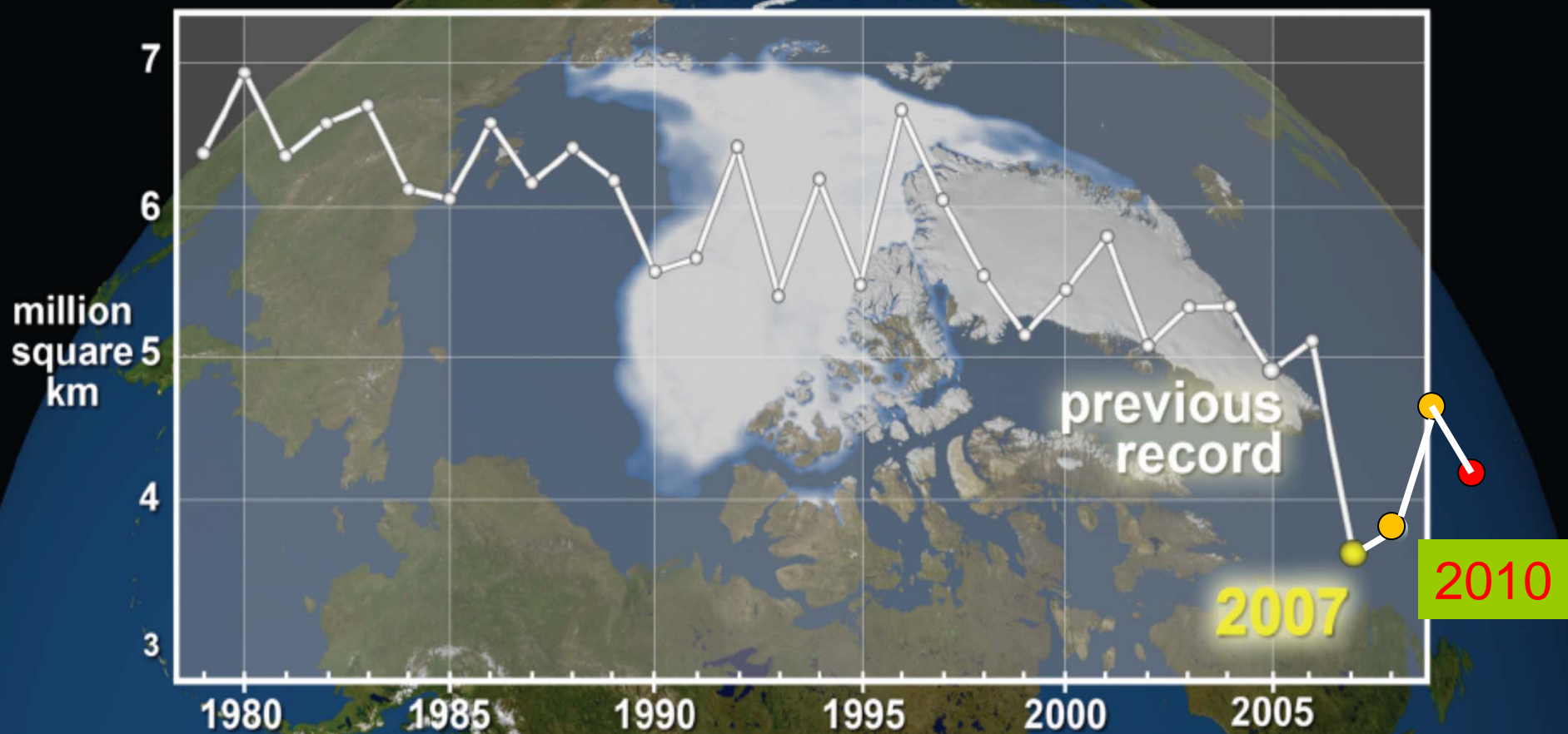


Image Source: NASA (svs.gsfc.nasa.gov)

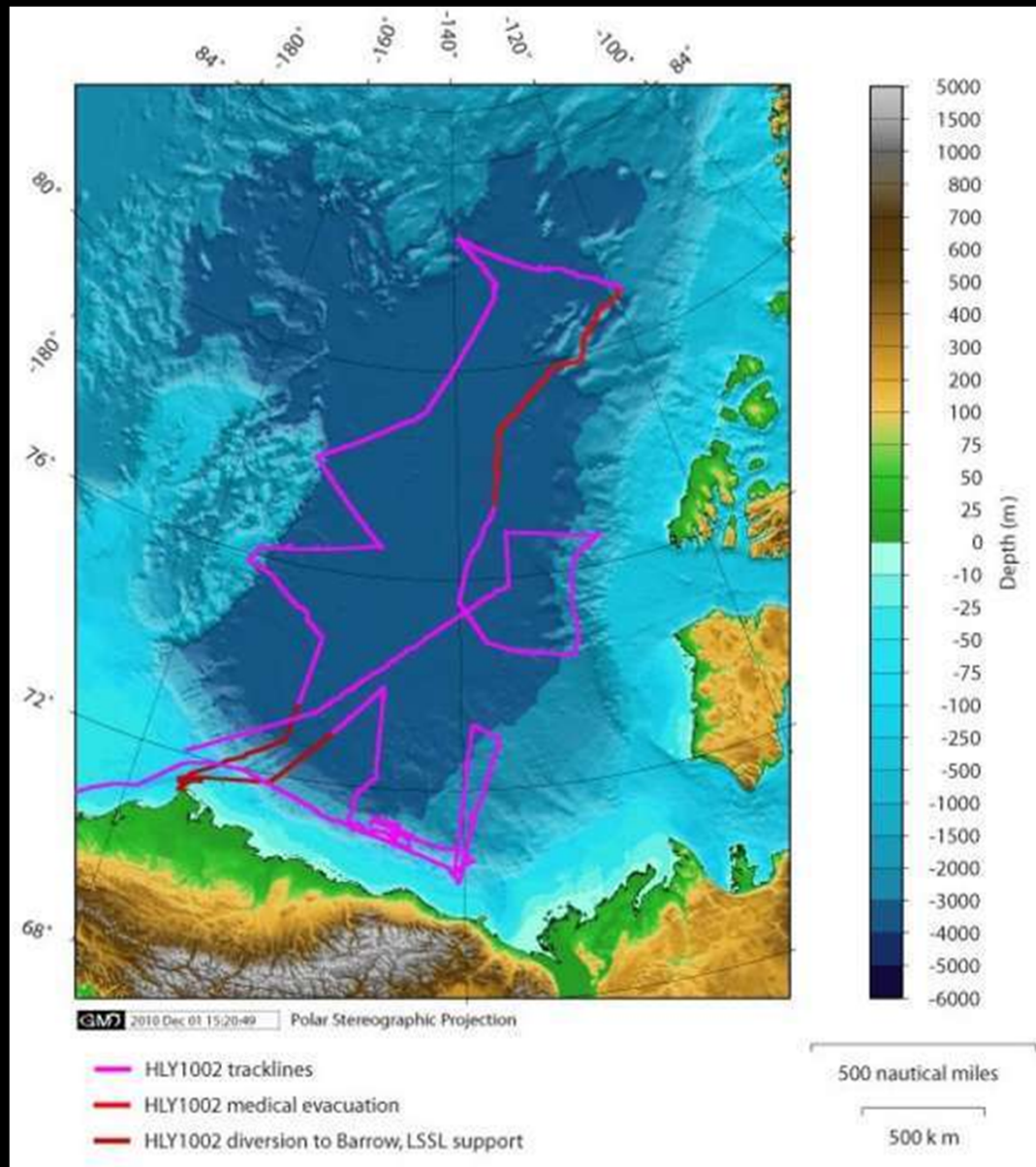
Healy 10-02 – Again – Joint with LSSL - seismic

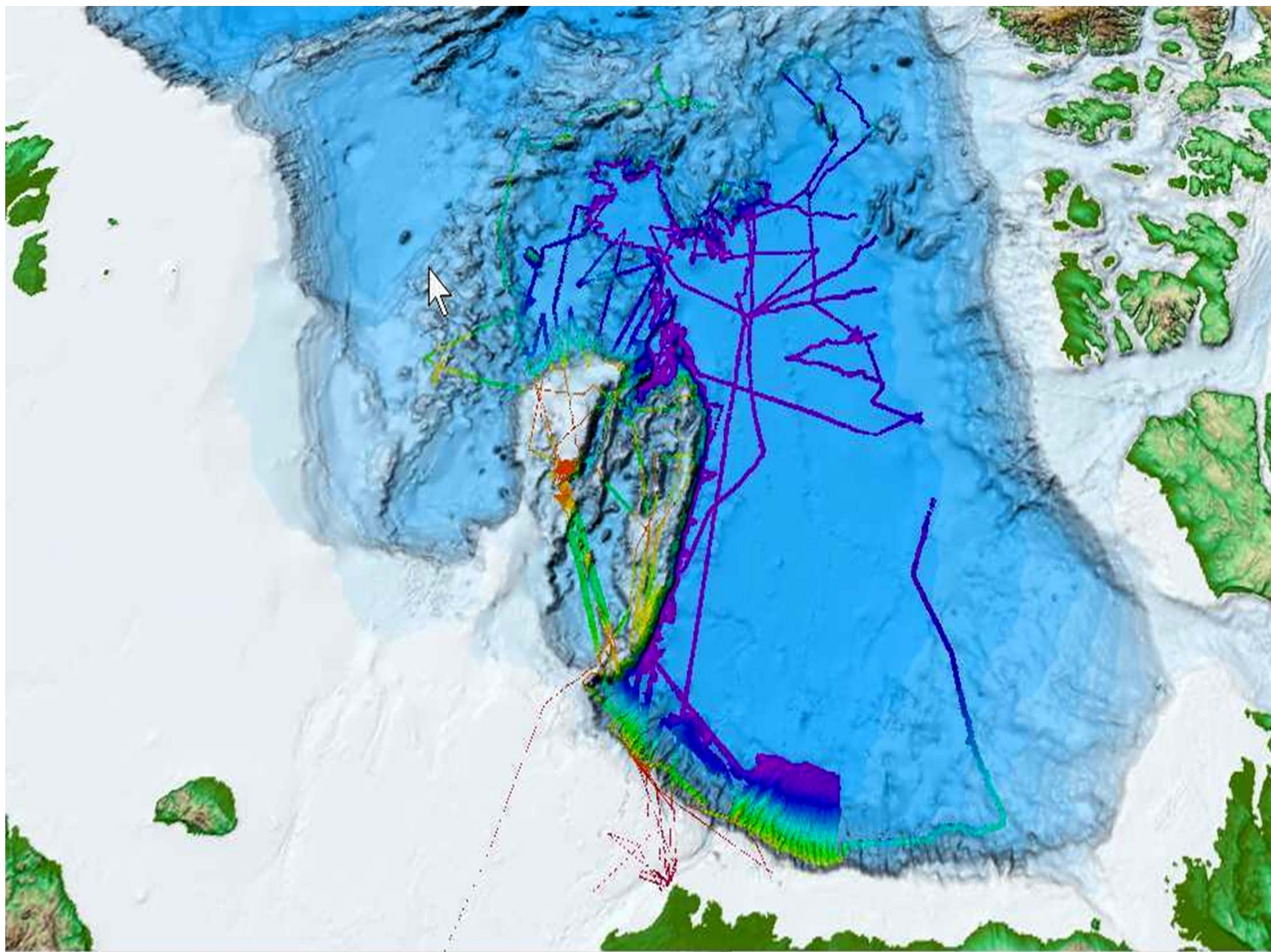
CCGS Louis S. St-Laurent

USCGC Healy



Healy 10-02







US ECS Arctic Mapping 2003, 2004, 2007, 2008, 2009, 2010

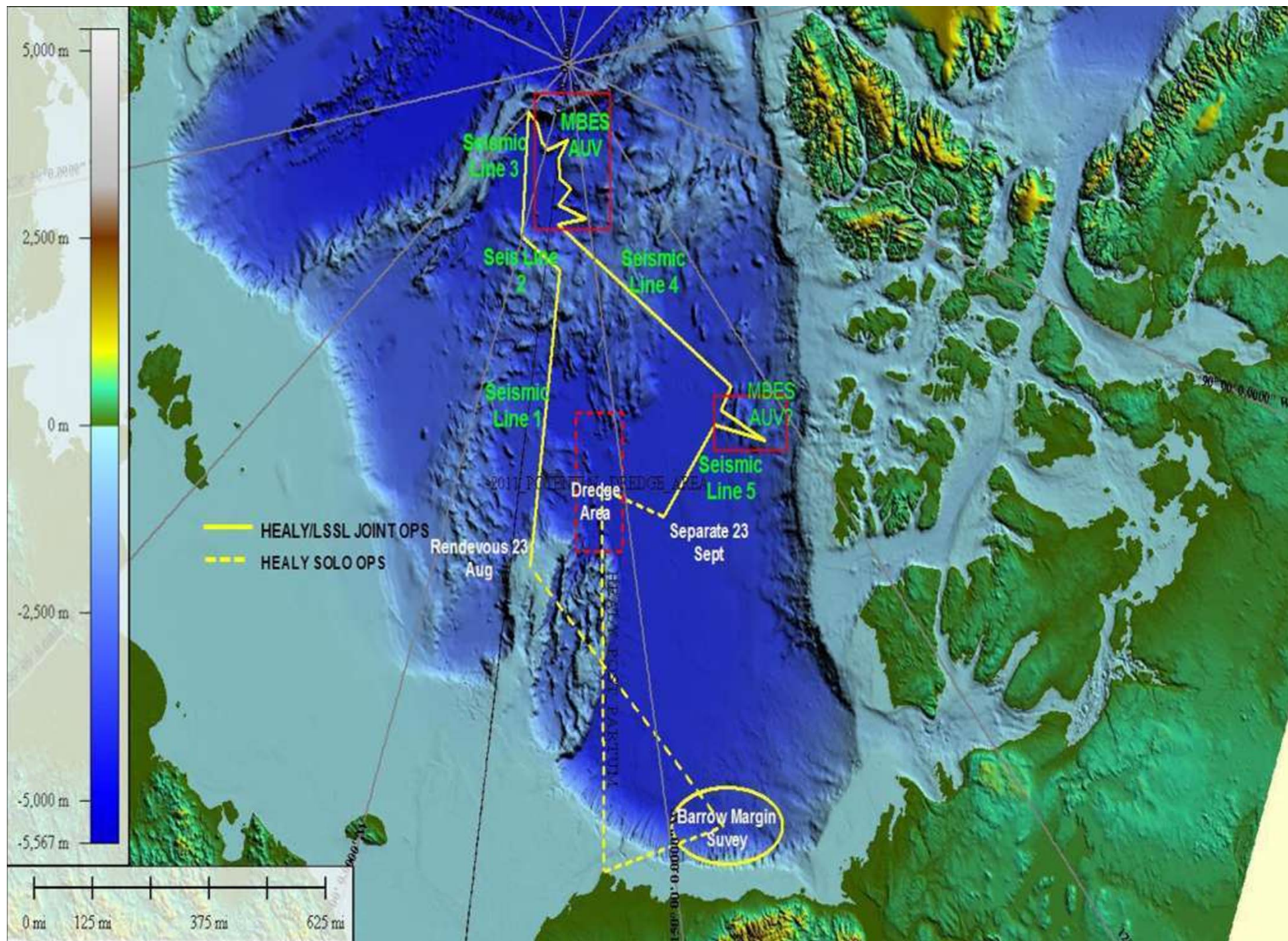
operations..... 147 days
transits..... 35 days
average speed (in ice)..... 4 kts
average sea-ice state..... 9/10
tracklines..... ~41,599 km
Area mapped..... ~262,000 km²

Healy 11-02

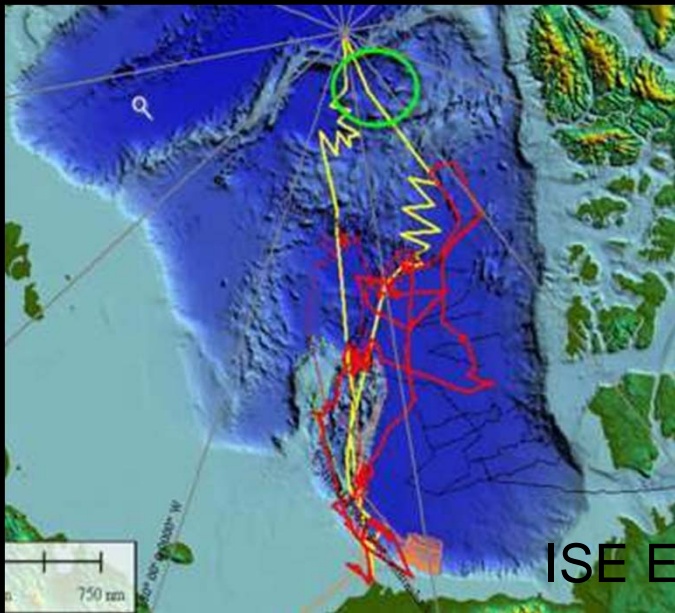
USCGC Healy

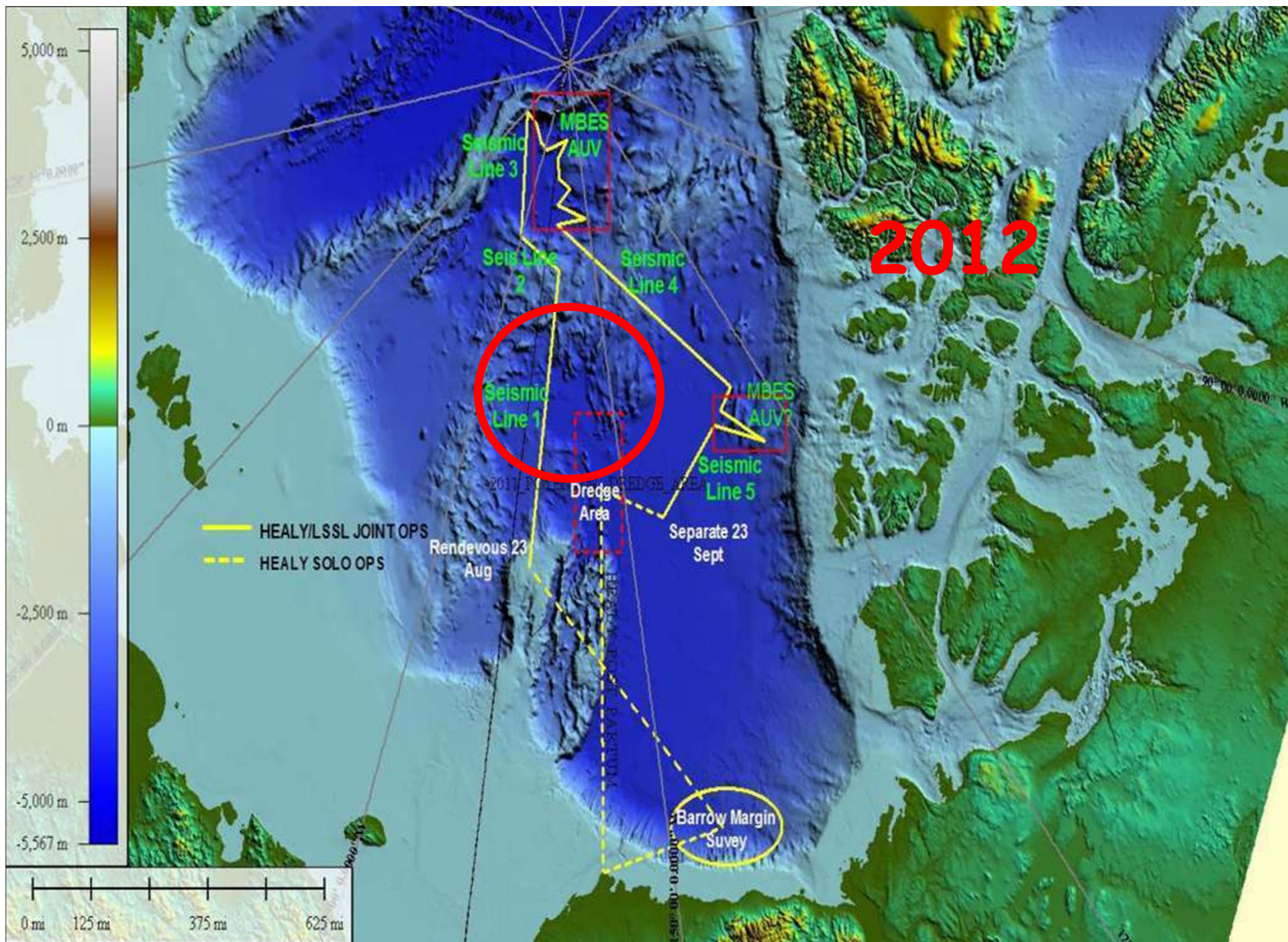
CCGS Louis S. St-Laurent



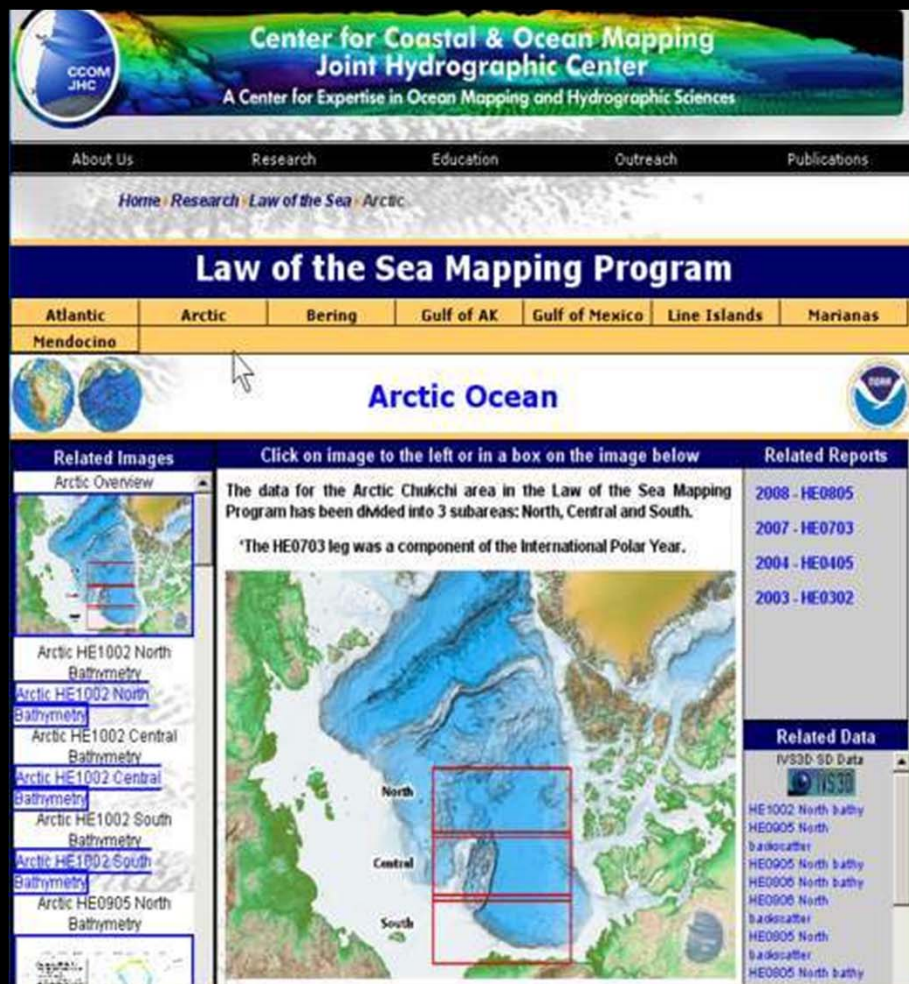


AUV OPS *Healy* / *Louis S. St. Laurent* 2011





ALL BATHYMETRIC DATA MADE AVAILABLE WITHIN A FEW MONTHS OF COLLECTION



Center for Coastal & Ocean Mapping
Joint Hydrographic Center
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Law of the Sea Mapping Program

Atlantic Arctic Bering Gulf of AK Gulf of Mexico Line Islands Marianas

Arctic Ocean

Related Images

Arctic Overview

Arctic HE1002 North Bathymetry

Arctic HE1002 North Bathymetry

Arctic HE1002 Central Bathymetry

Arctic HE1002 Central Bathymetry

Arctic HE1002 South Bathymetry

Arctic HE1002 South Bathymetry

Arctic HE0905 North Bathymetry

Click on image to the left or in a box on the image below

The data for the Arctic Chukchi area in the Law of the Sea Mapping Program has been divided into 3 subareas: North, Central and South.

*The HE0703 leg was a component of the International Polar Year.

Related Reports

2008 - HE0805

2007 - HE0703

2004 - HE0405

2003 - HE0302

Related Data

IVS3D SD Data

HE1002 North bathy

HE0905 North bathy

HE0905 North bathy

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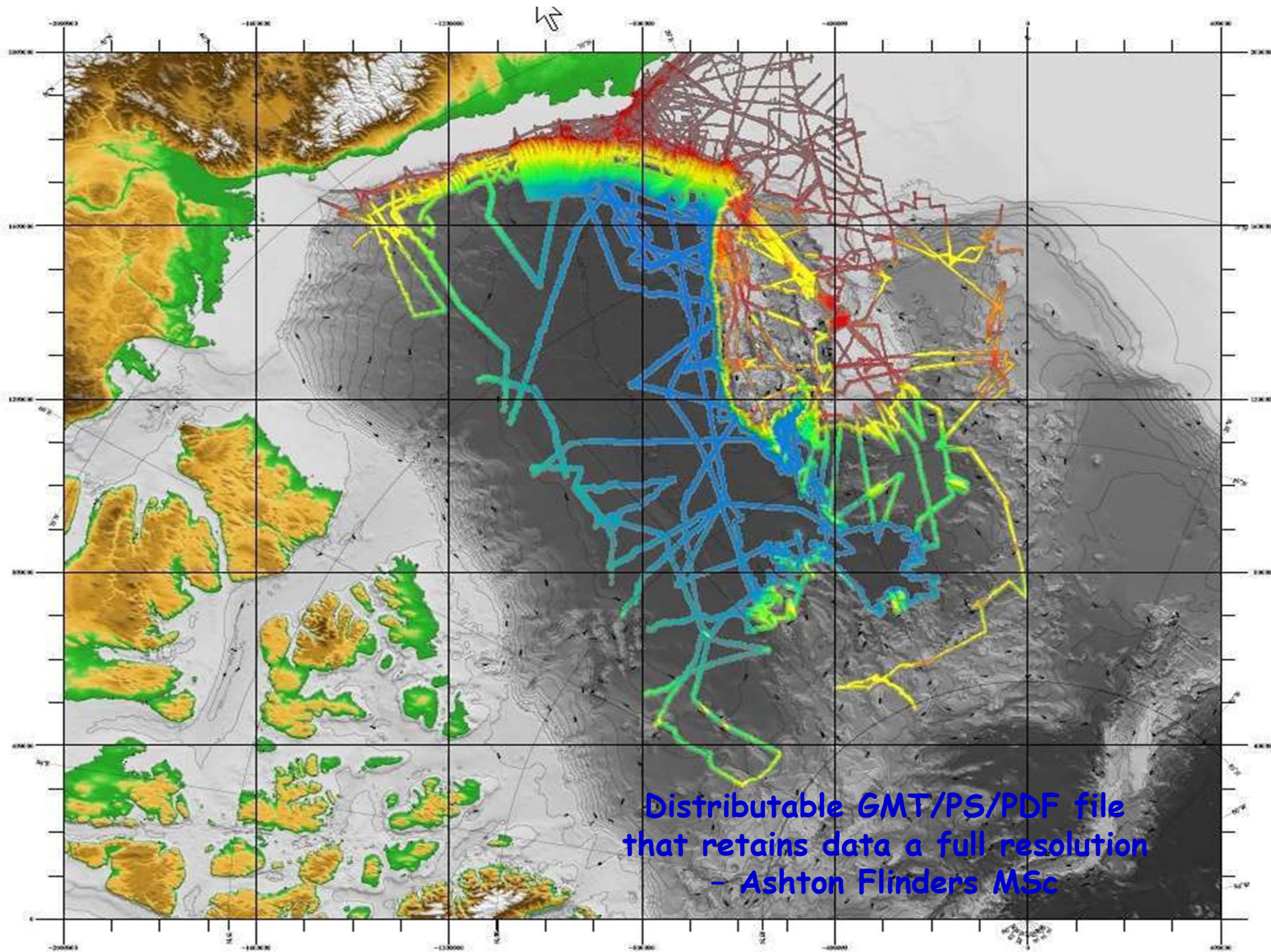
National
Geophysical
Data
Center

Natural Hazards

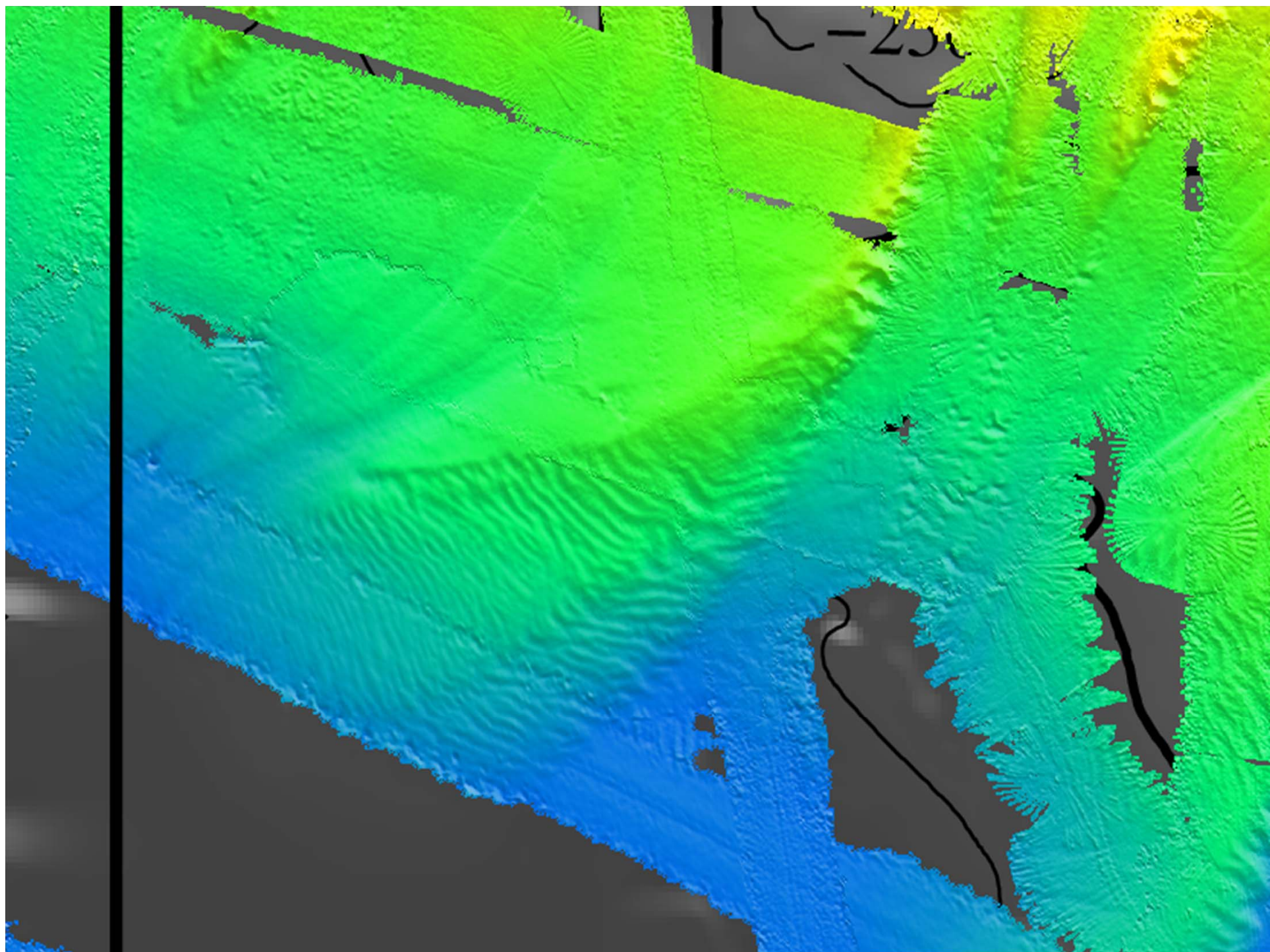
Marine Geology & Geophysics



Bathymetry
& Global Relief



Distributable GMT/PS/PDF file
that retains data at full resolution
- Ashton Flinders MSc

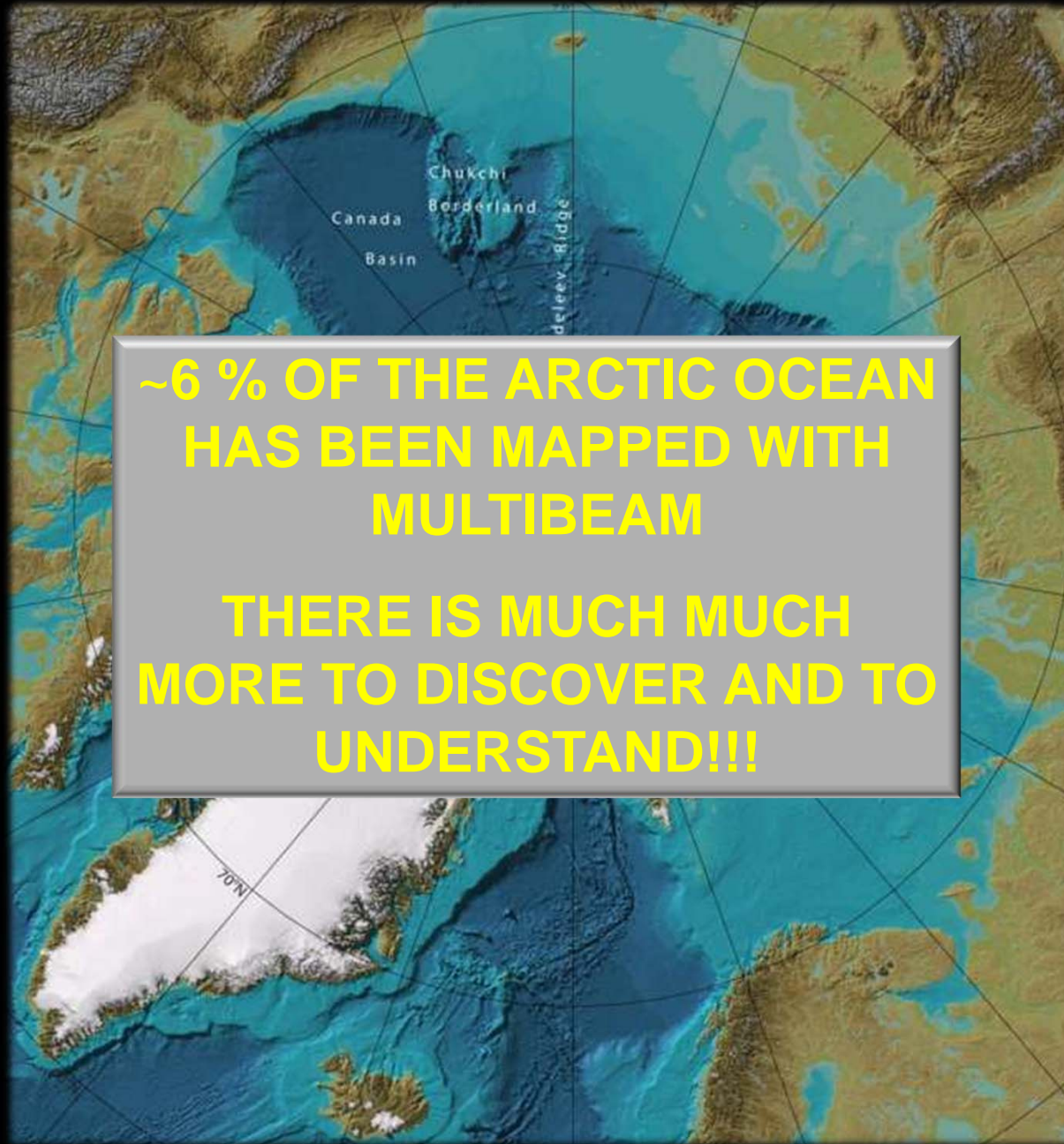


CHALLENGES

ACCESS!



IBCAO 2008



**~6 % OF THE ARCTIC OCEAN
HAS BEEN MAPPED WITH
MULTIBEAM**

**THERE IS MUCH MUCH
MORE TO DISCOVER AND TO
UNDERSTAND!!!**

HEALY'S PRIMARY MISSION IS RESEARCH



“HEALY is designed to conduct a wide range of research activities, providing more than 4,200 square feet of scientific laboratory space, numerous electronic sensor systems, oceanographic winches, and accommodations for up to 50 scientists. The science community provided invaluable input on lab lay-outs and science capabilities during design and construction of the ship. At a time when scientific interest in the Arctic Ocean basin is intensifying, HEALY substantially enhances the United States Arctic research capability.”

“As a Coast Guard cutter, HEALY is also a capable platform for supporting other potential missions in the polar regions, including logistics, search and rescue, ship escort, environmental protection, and enforcement of laws and treaties.”



