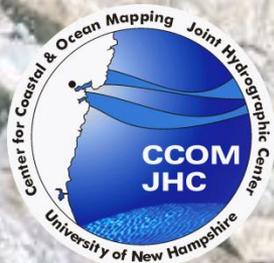


# Status of U.S. Arctic ECS Mapping Activities:

Larry Mayer  
Professor and Director  
Center for Coastal and  
Ocean Mapping  
University of New  
Hampshire, USA



# USCGC *Healy*

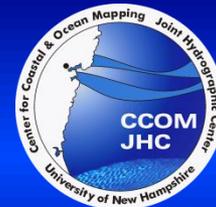


Length, Overall = 128 meters	Beam = 25 m	Propulsion = Diesel/Electric
Displacement = 16,000 LT	Shaft HP = 30,000 HP	Props = 2 fixed pitch
Cruising Speed = 12 knots.	Max Speed – 17 knts	Fuel Cap = 4.62 M liters
Icebreaking = 1.4 m continuous, 2.44 m backing and ramming		
Accommodations = 19 Officer, 12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

Full suite of scientific gear including:

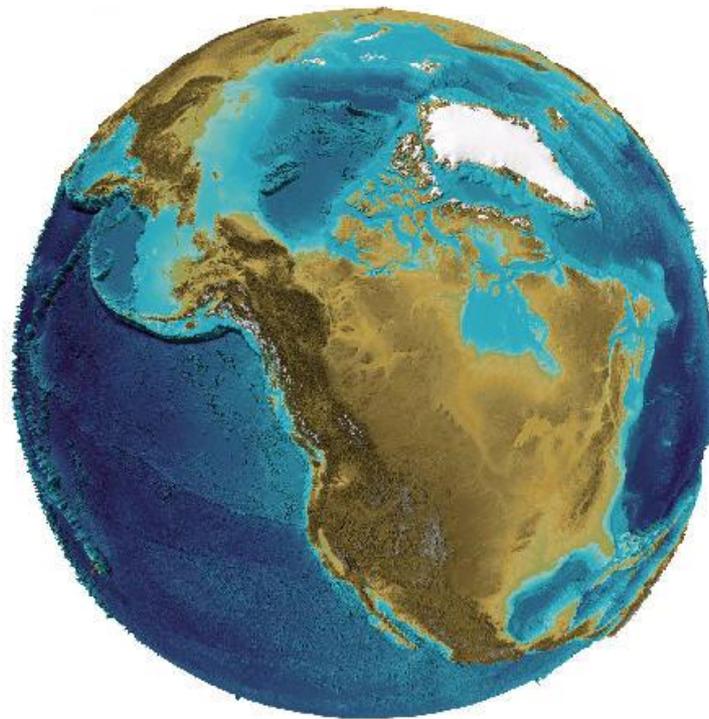
**2001-2009 – Seabeam 2112 2x2 deg 12 kHz MBES**

**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

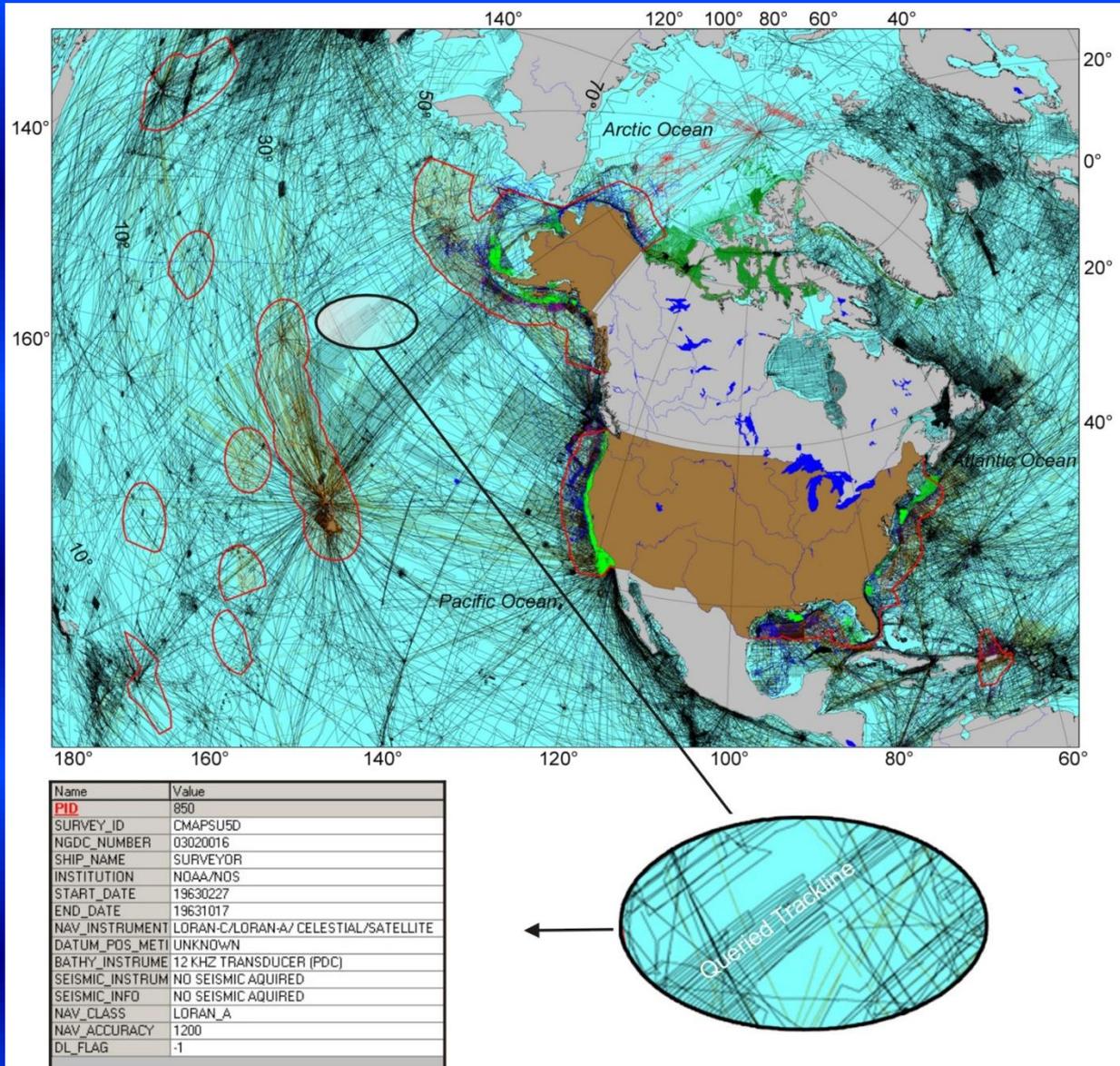
Durham, N.H.  
May, 2002

Larry Mayer, Martin Jakobsson and Andrew Armstrong



# U.S. LoS Database

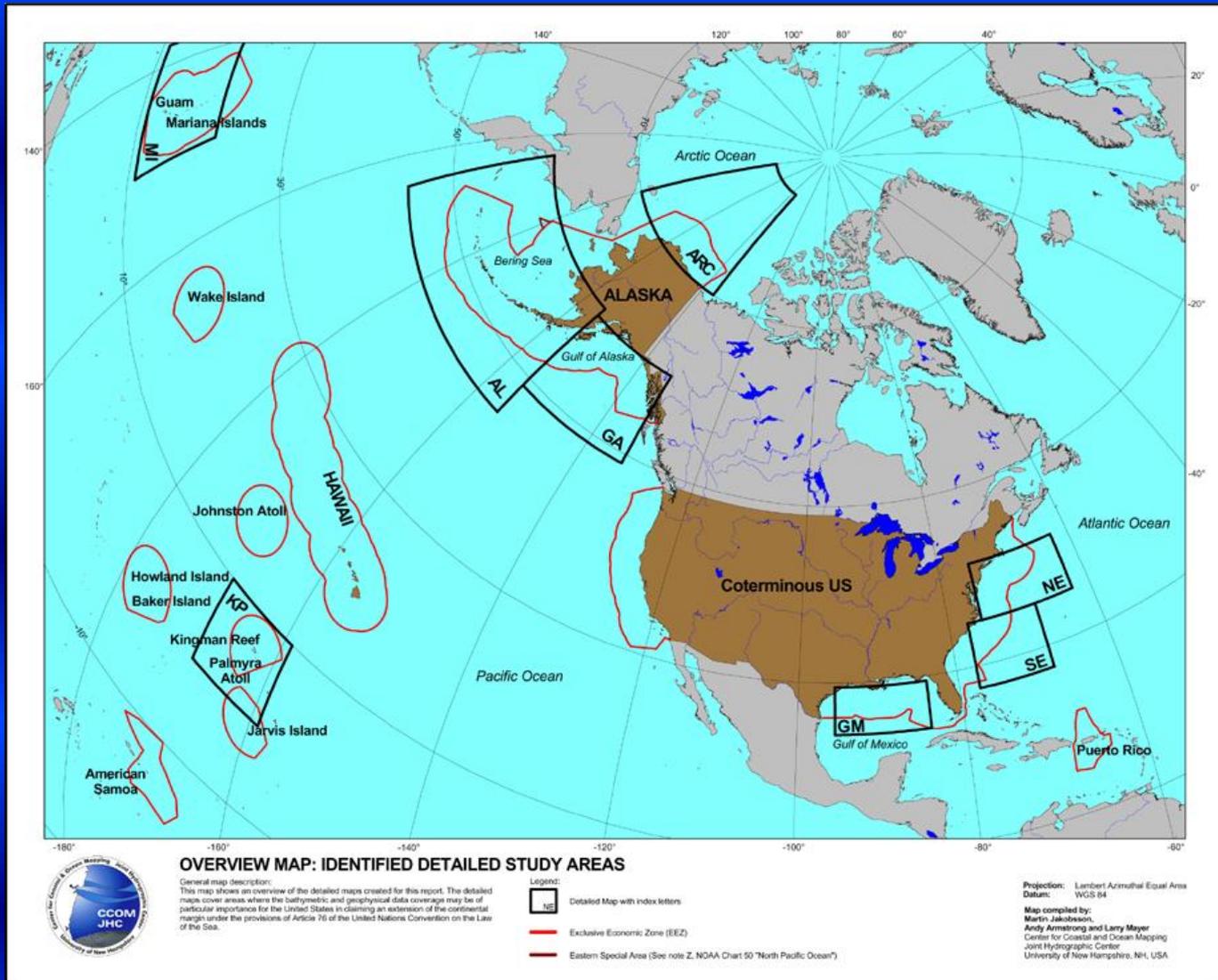
- 39861 tracklines
- 6037 survey polygons
- millions of soundings
- data compilations



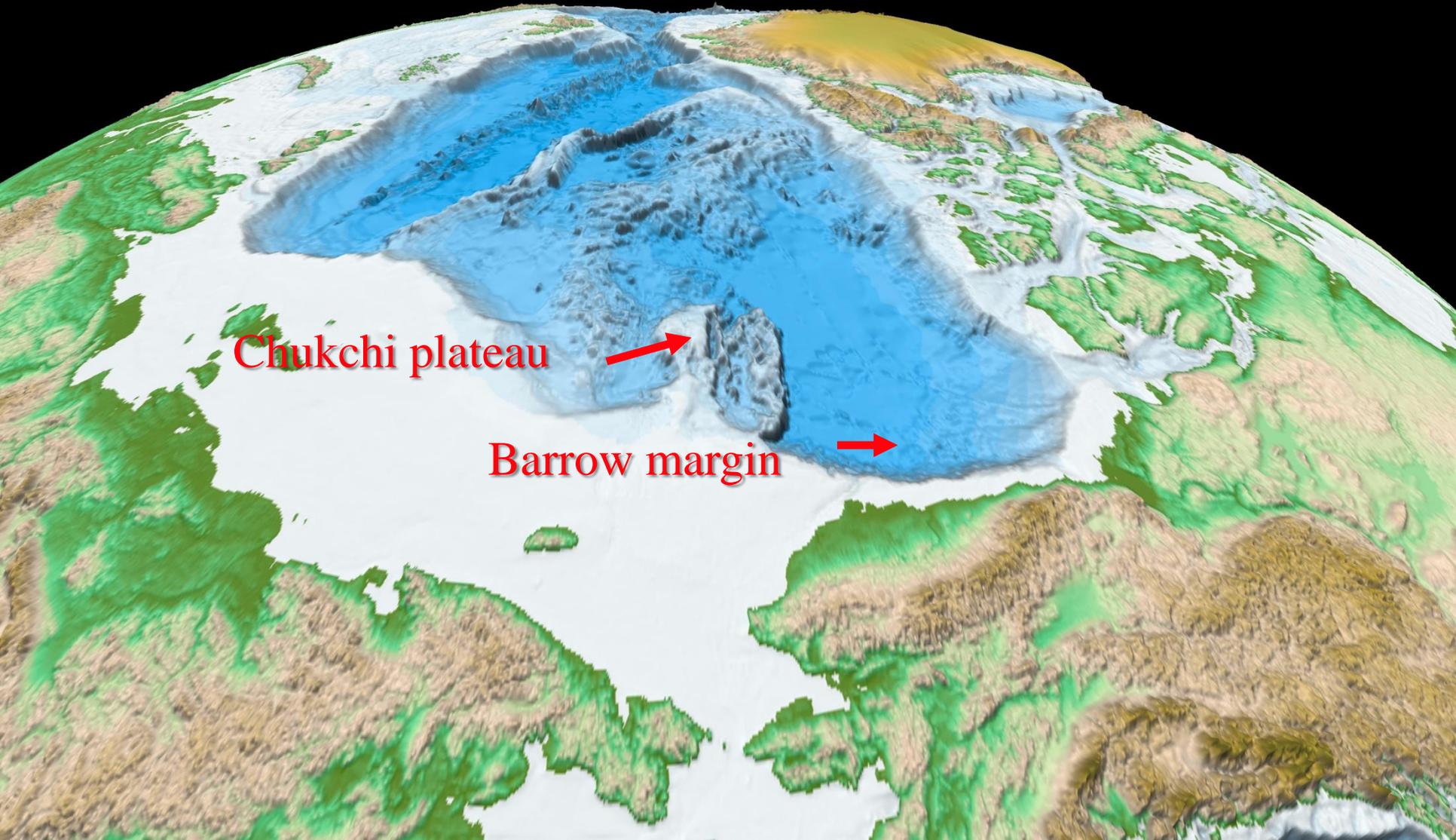
# Initial Analysis

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

For each area determine key features required

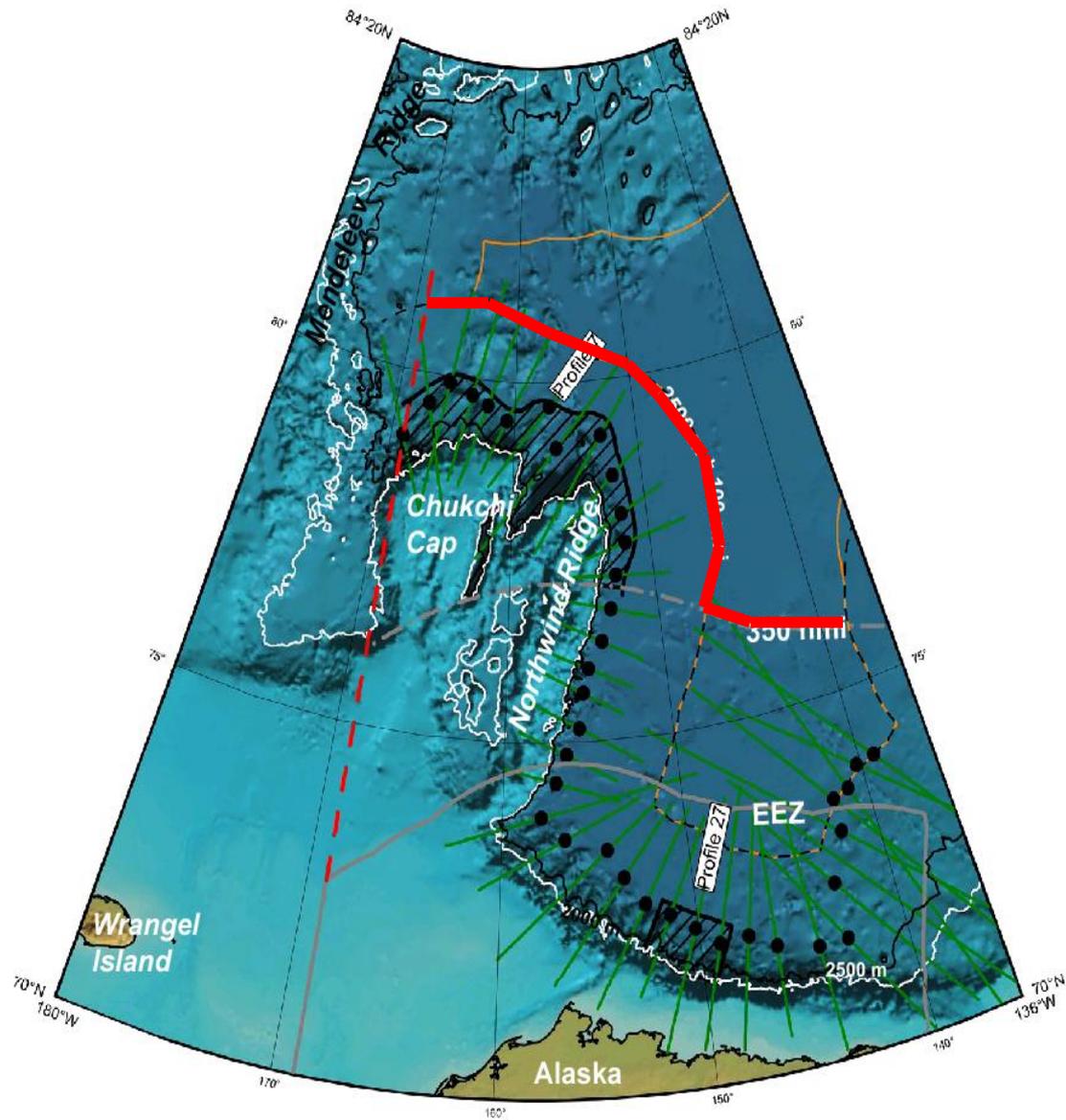
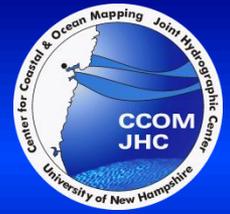


# Chukchi Region and Barrow Margin



Chukchi plateau

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

Arctic  
2003 2004 2007  
2008 2009 2010

Atlantic  
2004 2005  
2008 soon

Bering Sea  
2003

Gulf of Alaska  
2005

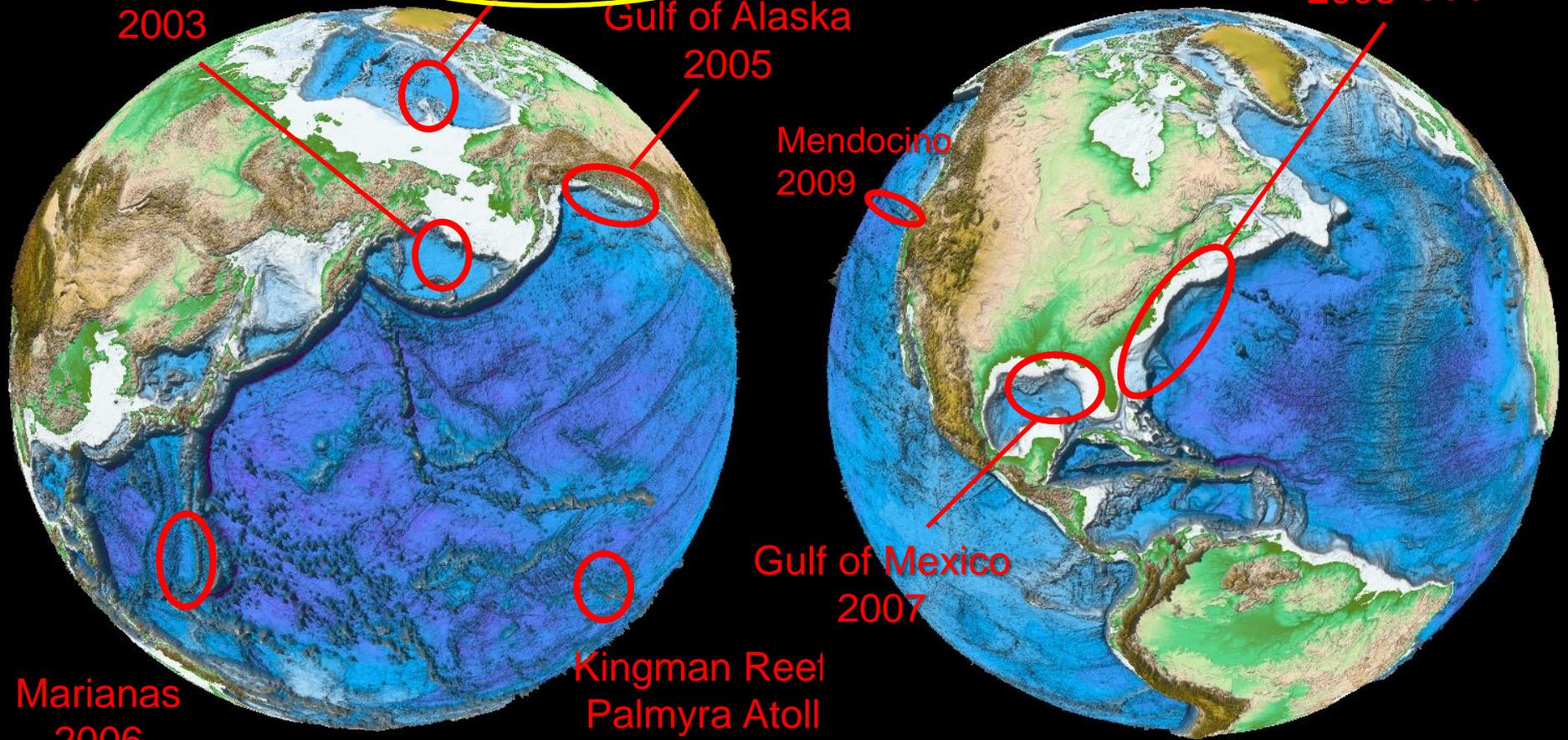
Mendocino  
2009

Gulf of Mexico  
2007

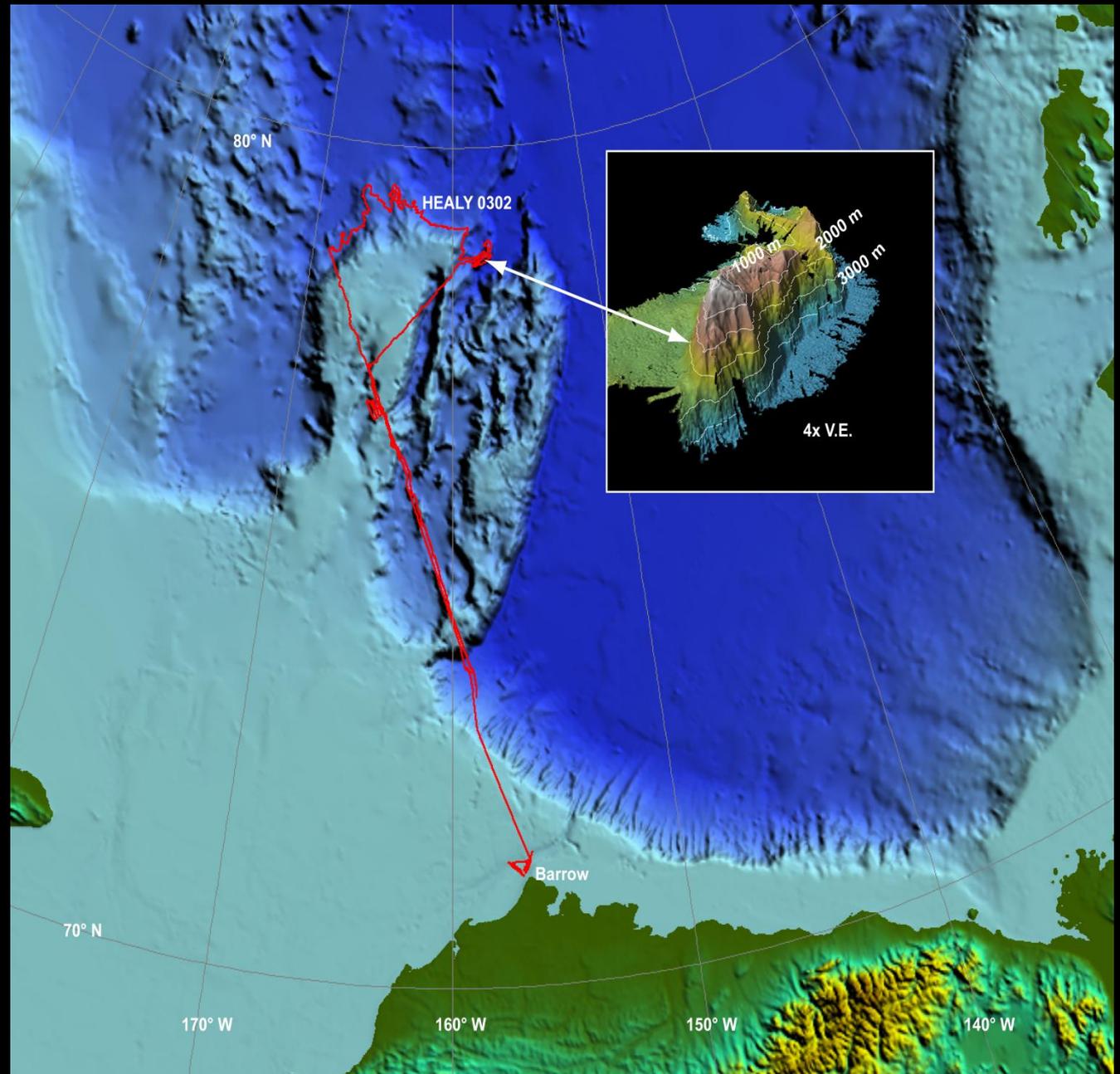
Marianas  
2006  
2007, 2010

Kingman Reel  
Palmyra Atoll  
2010

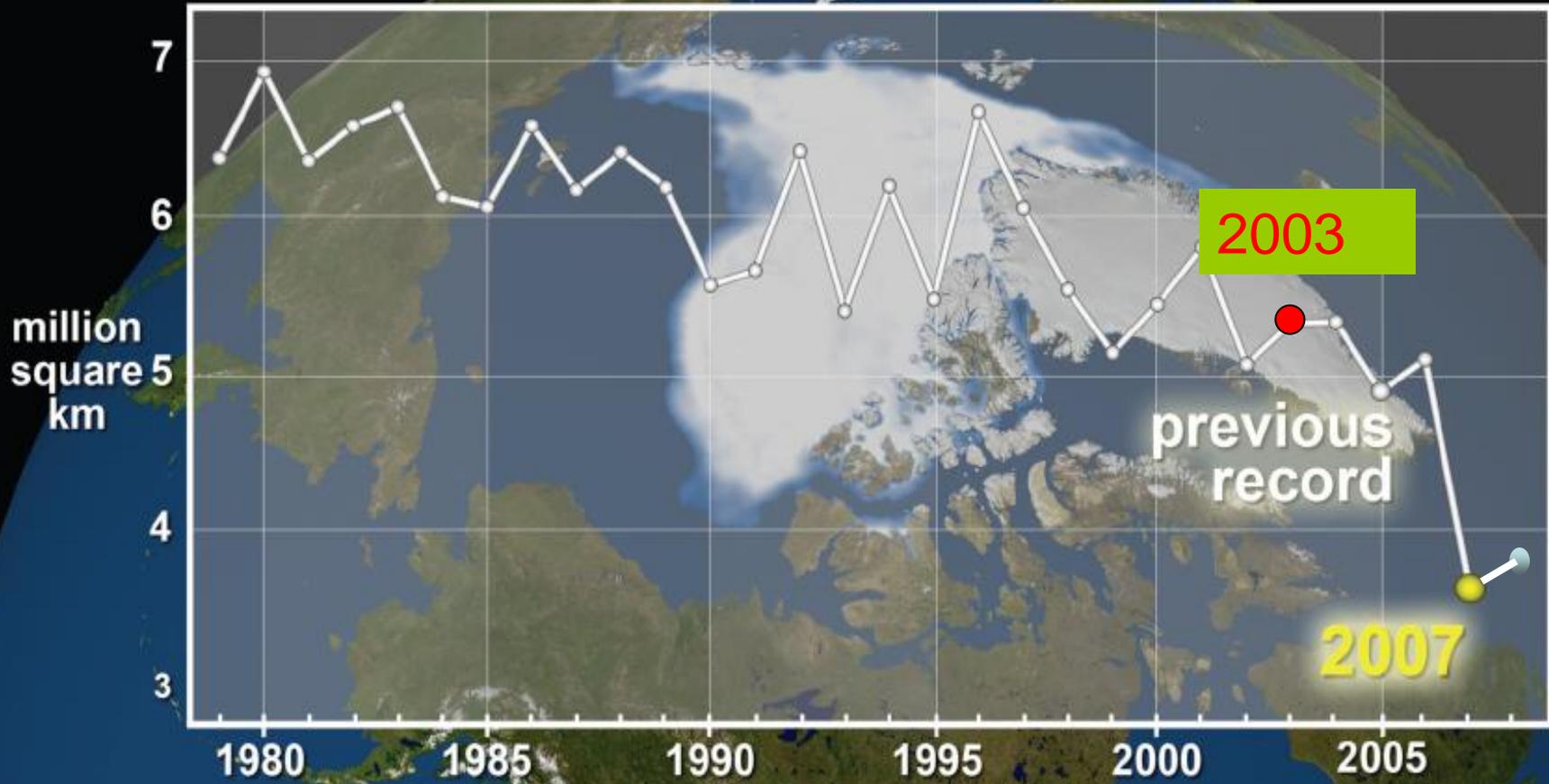
> 1,649,600 km<sup>2</sup>



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



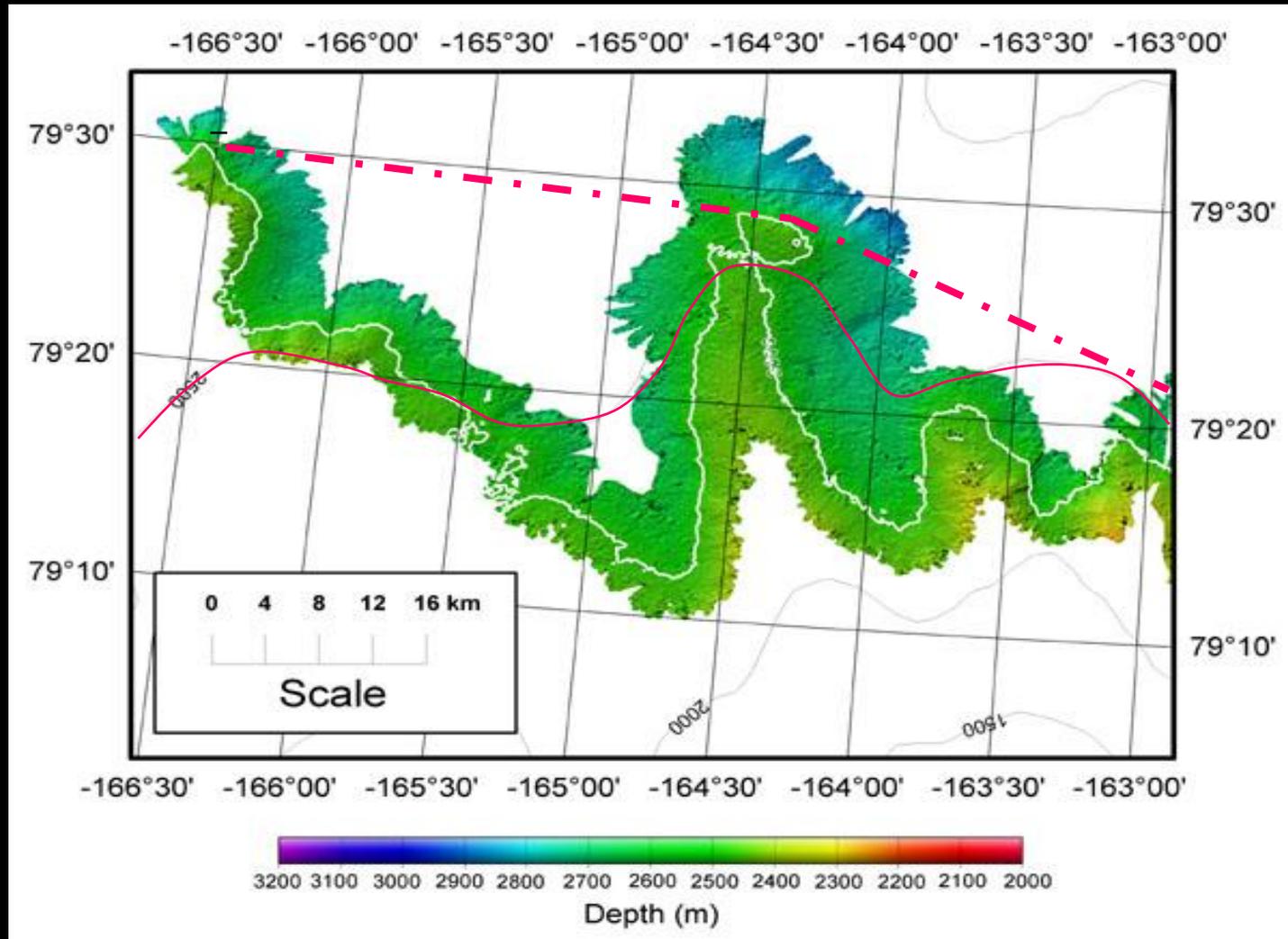
# Annual Sea Ice Minimum



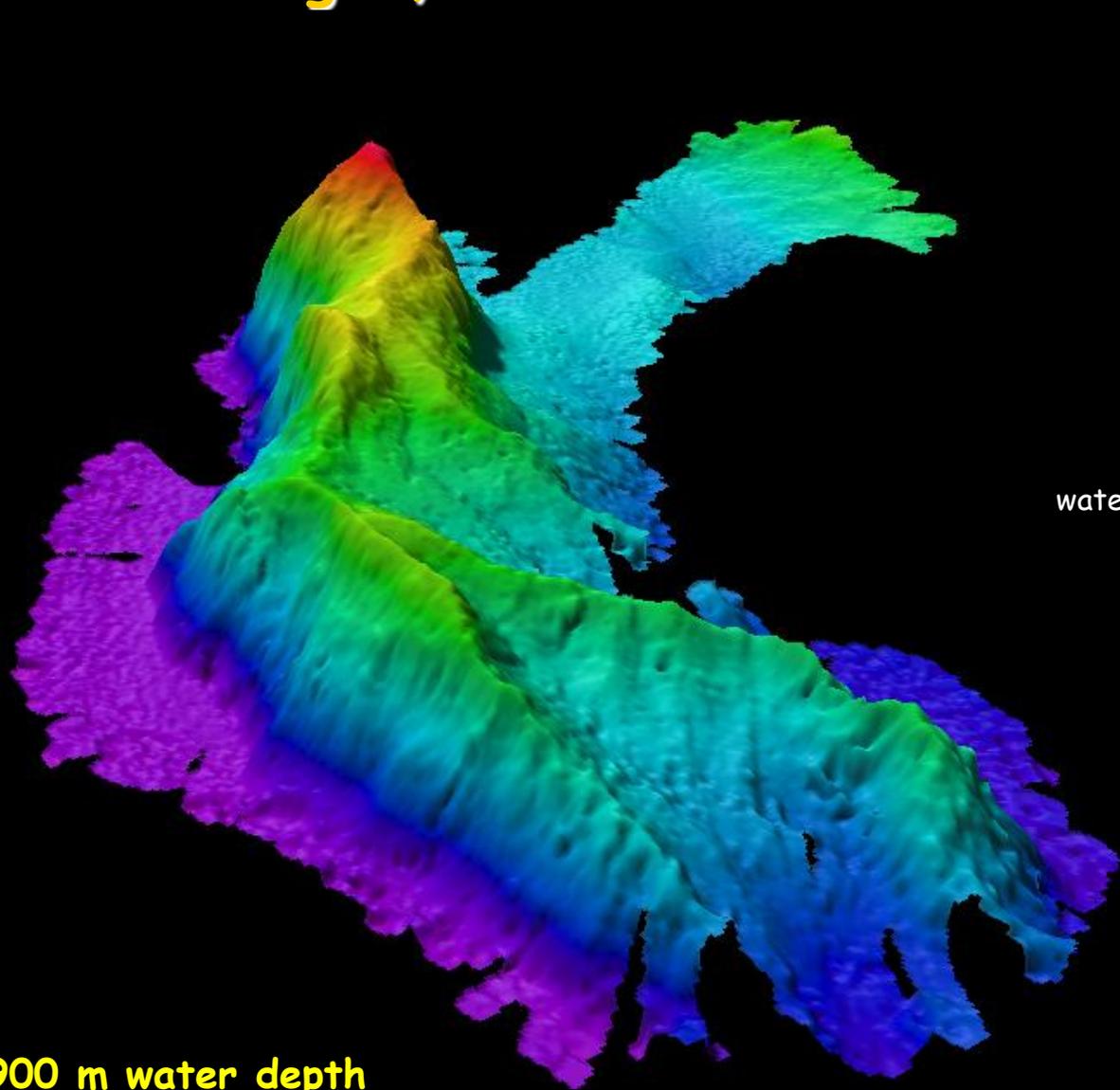
typical ice conditions  
2003  
8/10 "cheesy" ice



# Redefinition of the 2500 m contour



# Healy Seamount looking S, ve=6x

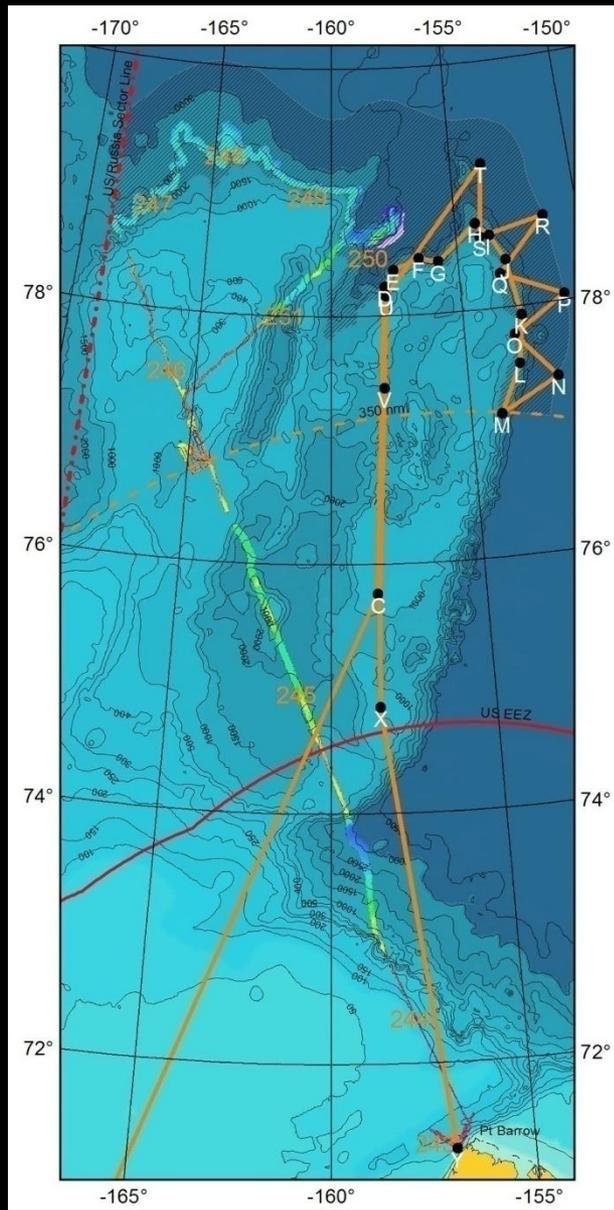


water depth (m)

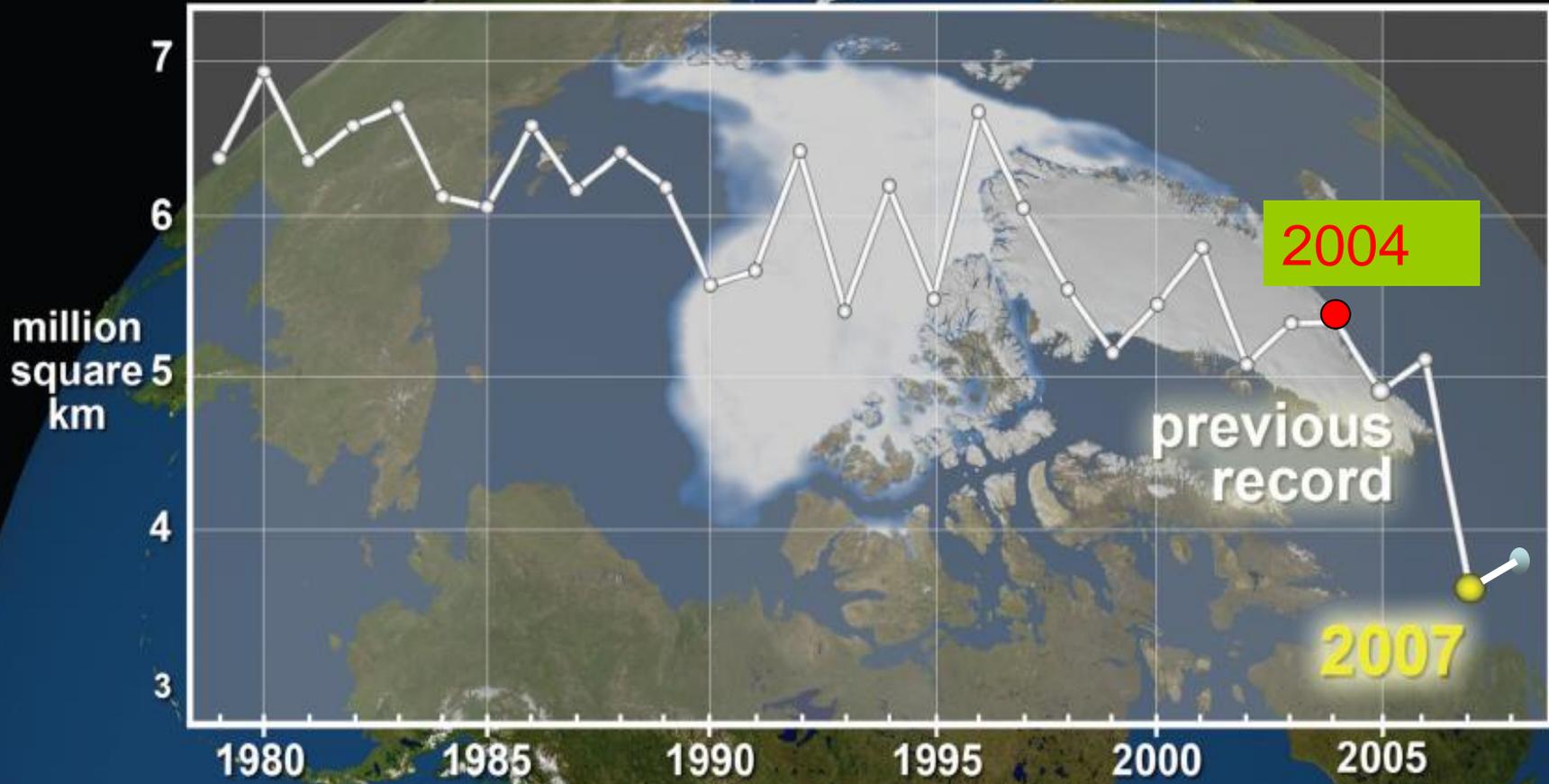
3100 m high, summit at 900 m water depth

45 km long x 15 km wide

# HEALY 2004 - Plan

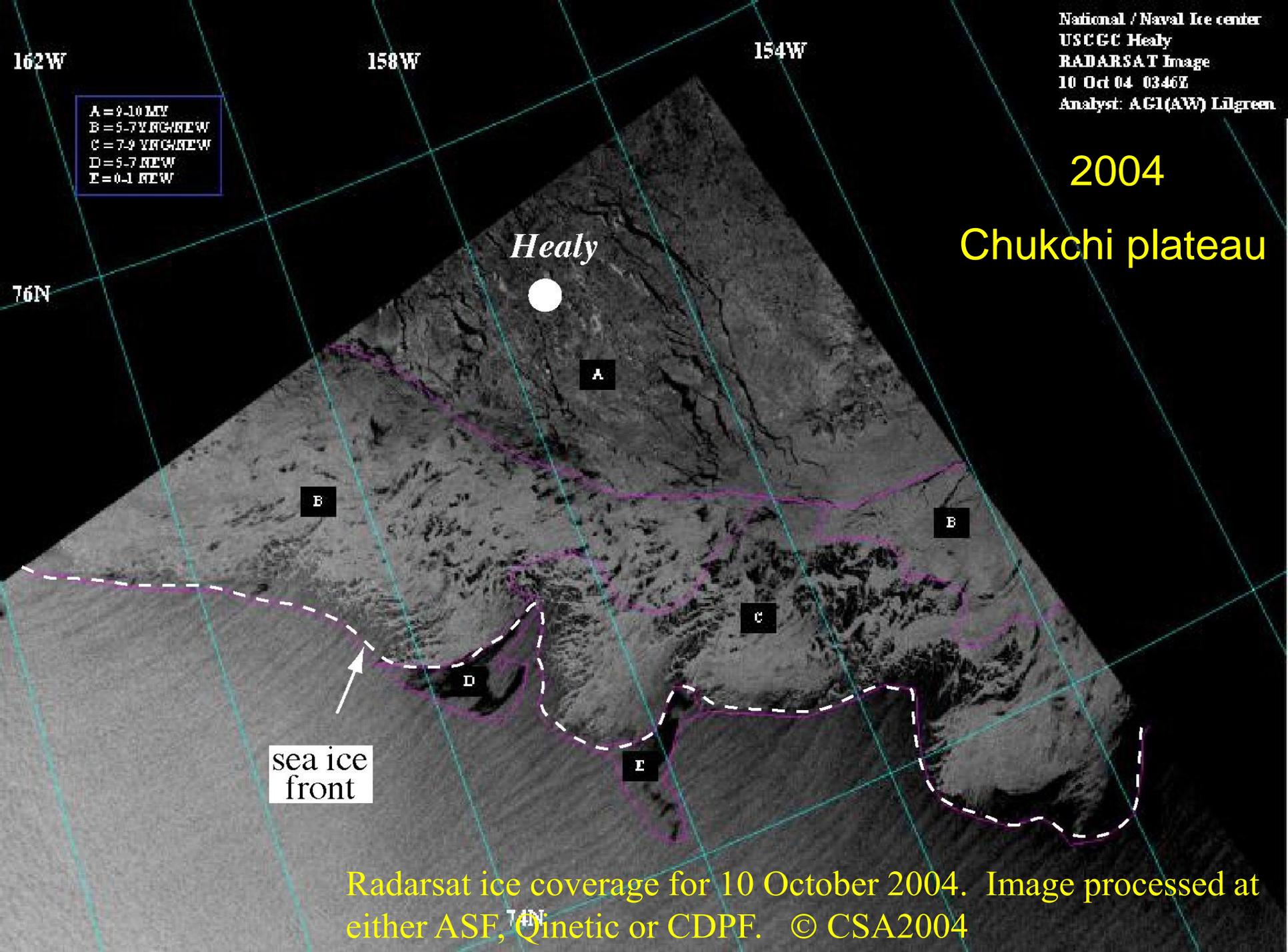


# Annual Sea Ice Minimum



2004

Chukchi plateau



162W

158W

154W

76N

Healy

A

B

B

C

D

E

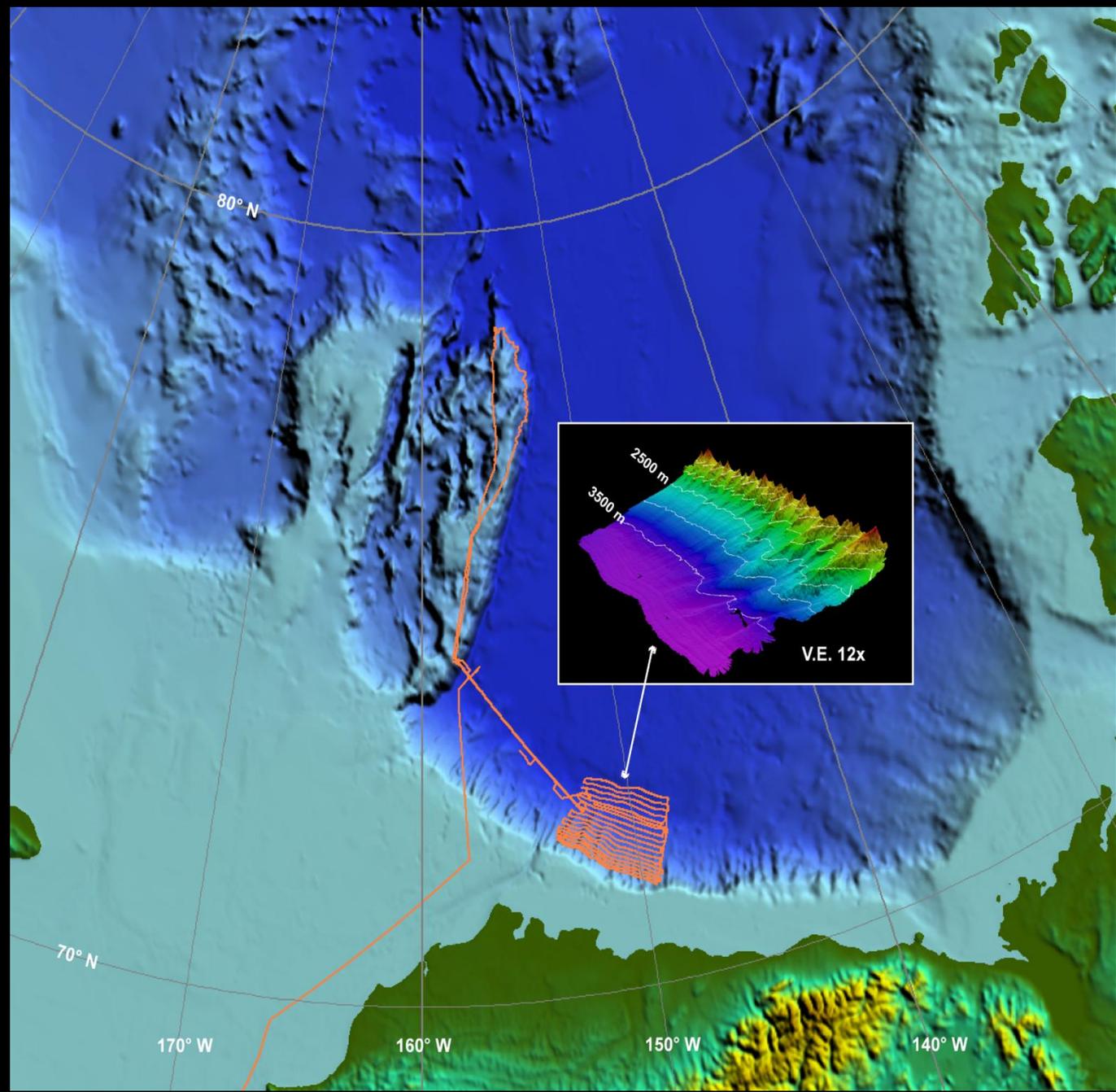
sea ice front

Radarsat ice coverage for 10 October 2004. Image processed at either ASF, Qinetiq or CDPF. © CSA2004

How do we map in this?



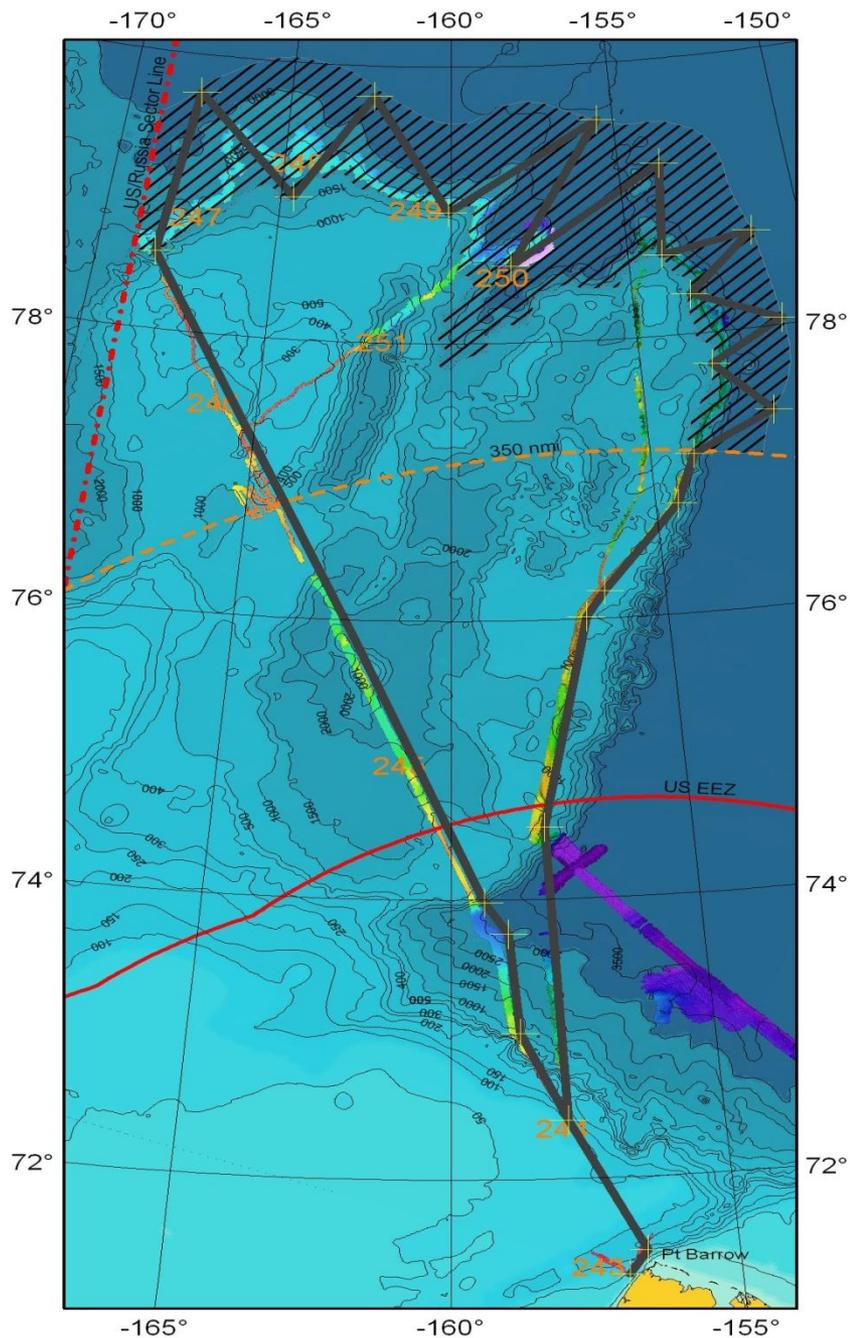
HEALY 04-05  
TRACK  
6-26 Oct. 2004  
6700 line km



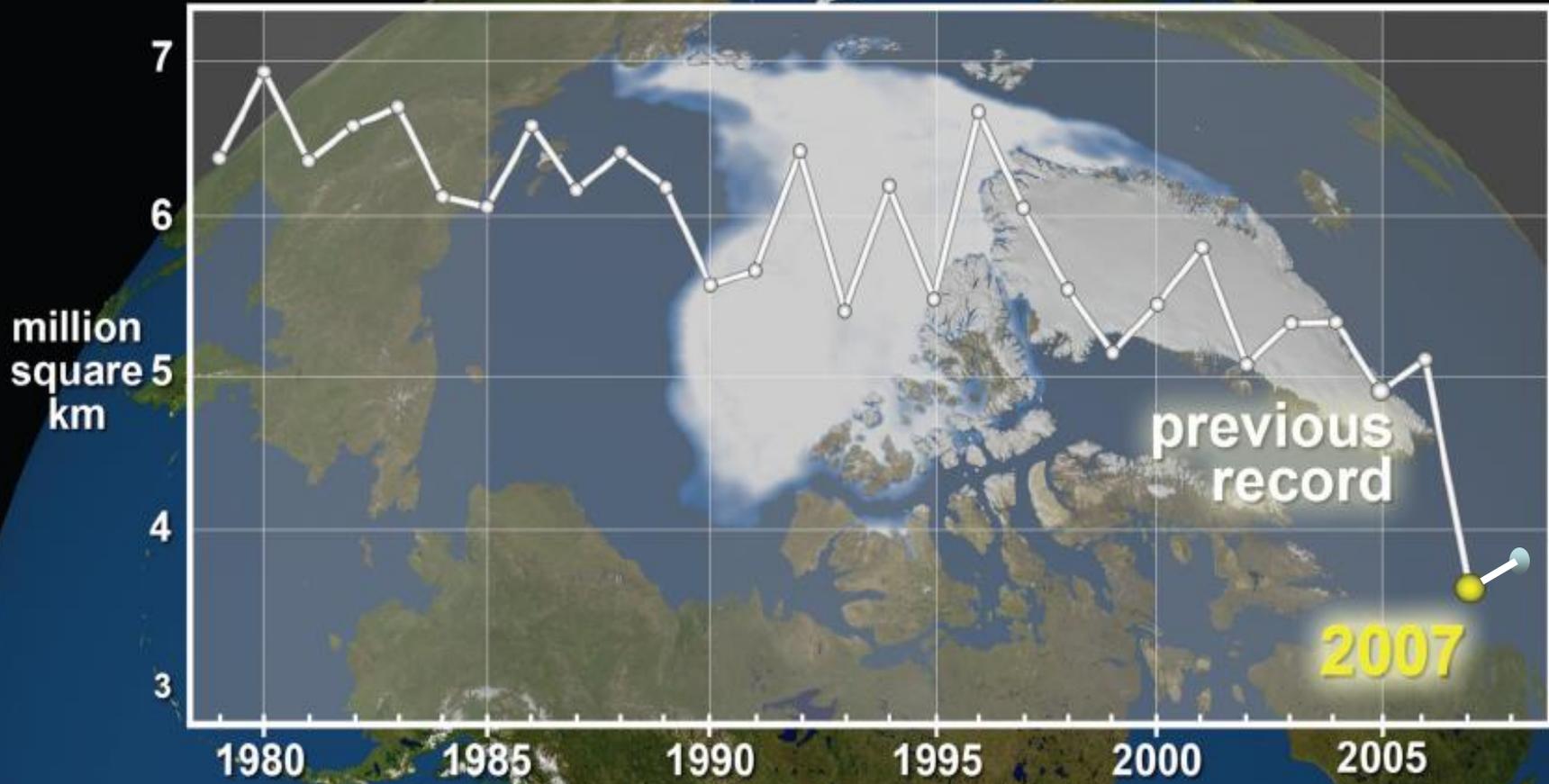
“Ratchet Surveying”  
“Pirouette Surveying”

# HEALY 07-03 Plan

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



# Annual Sea Ice Minimum



previous record

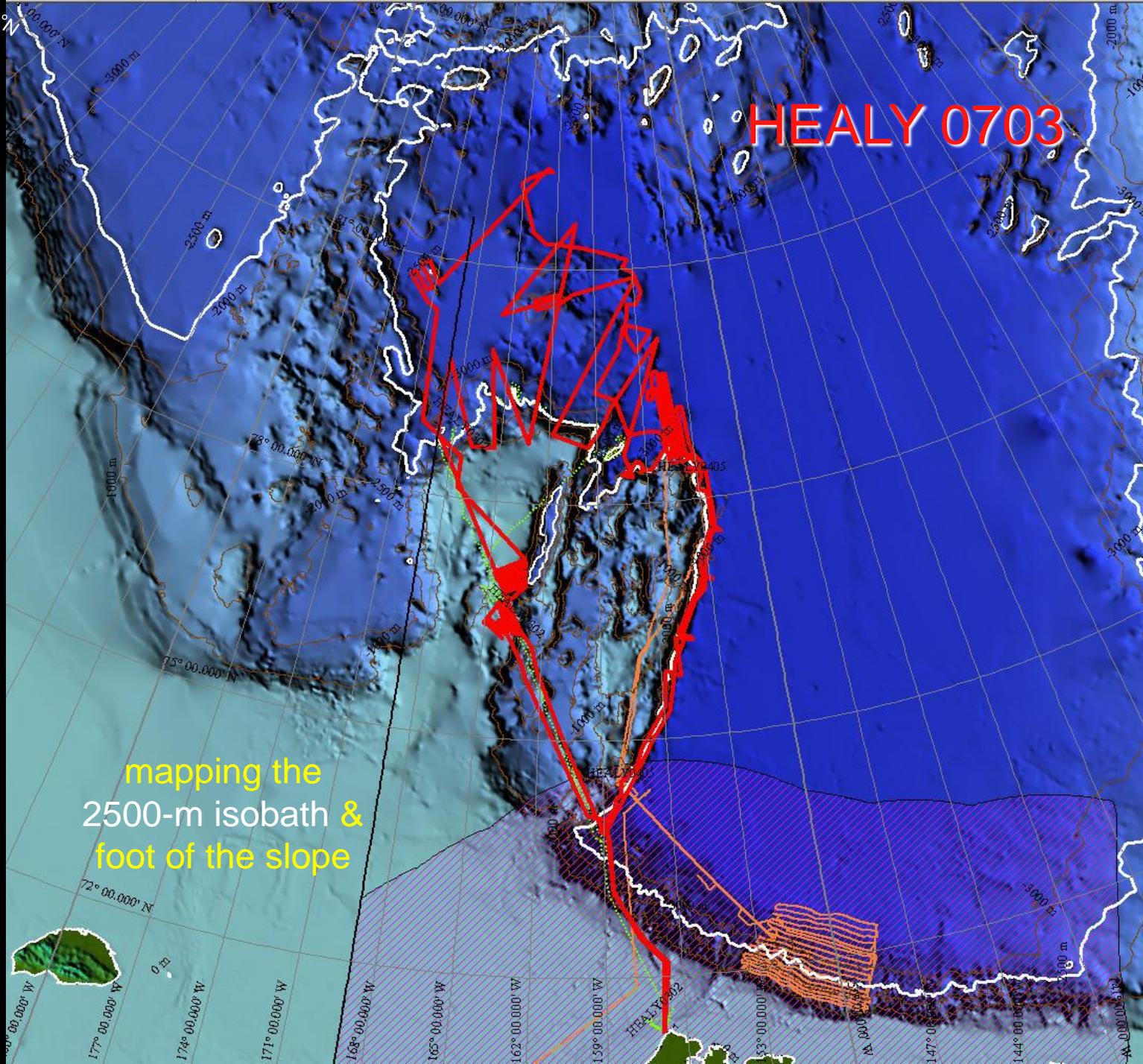
2007



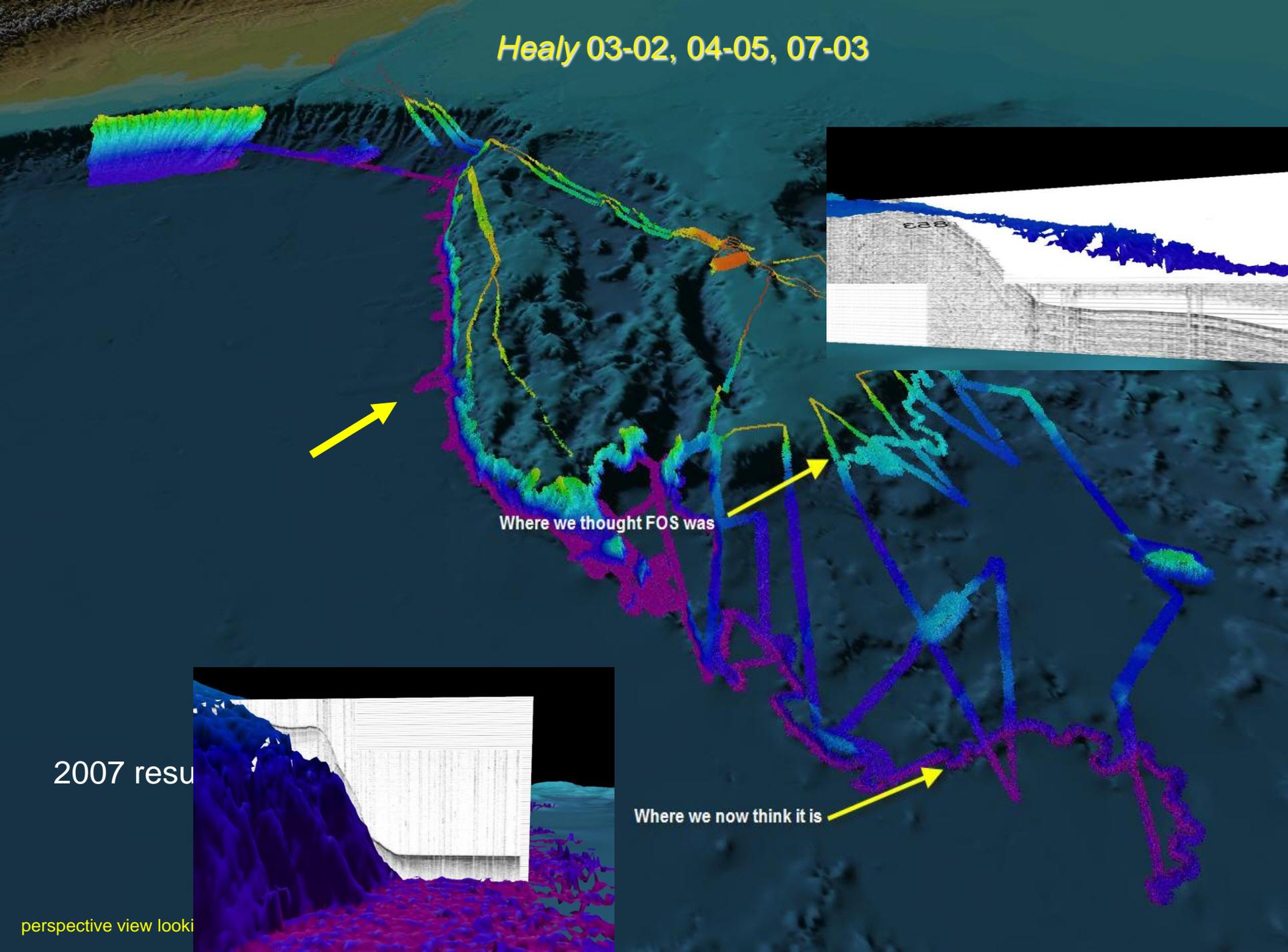


HEALY 0703

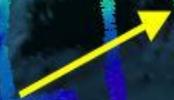
mapping the  
2500-m isobath &  
foot of the slope



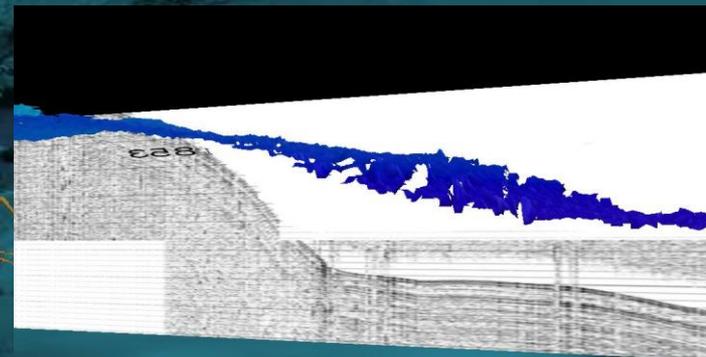
Healy 03-02, 04-05, 07-03



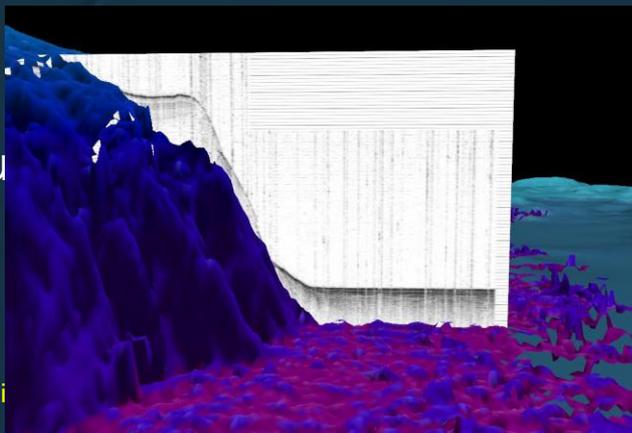
Where we thought FOS was



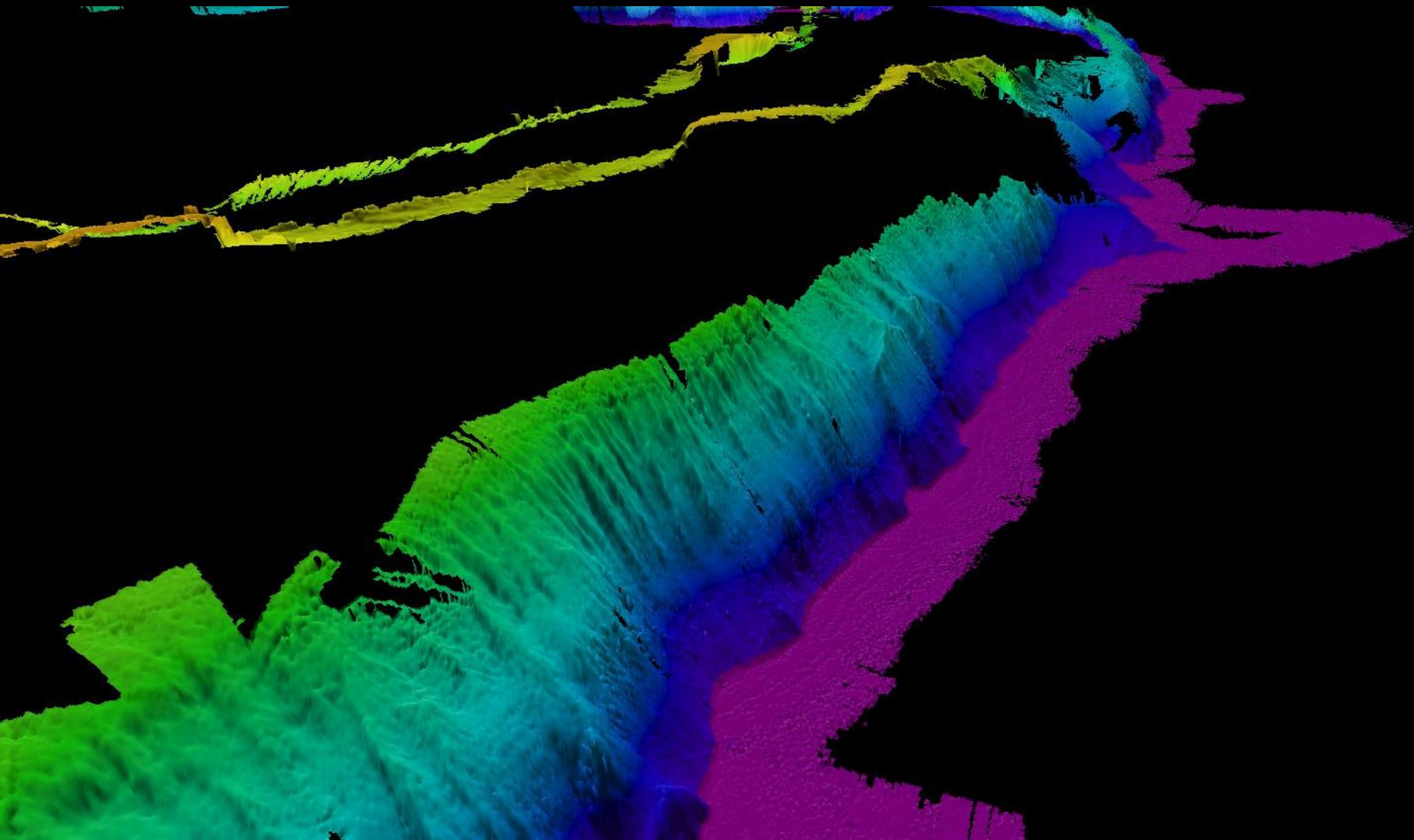
Where we now think it is

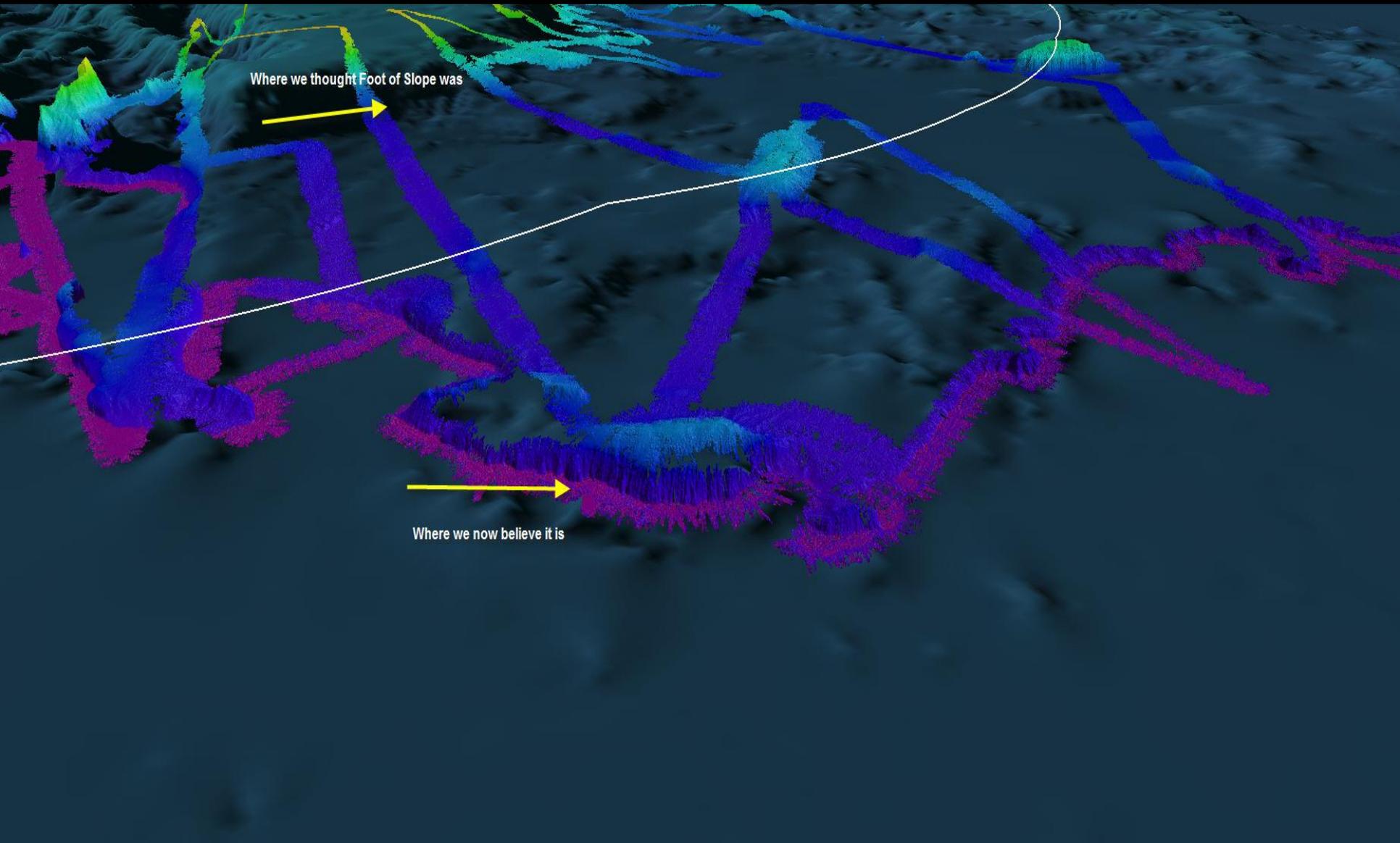


2007 result



perspective view looki

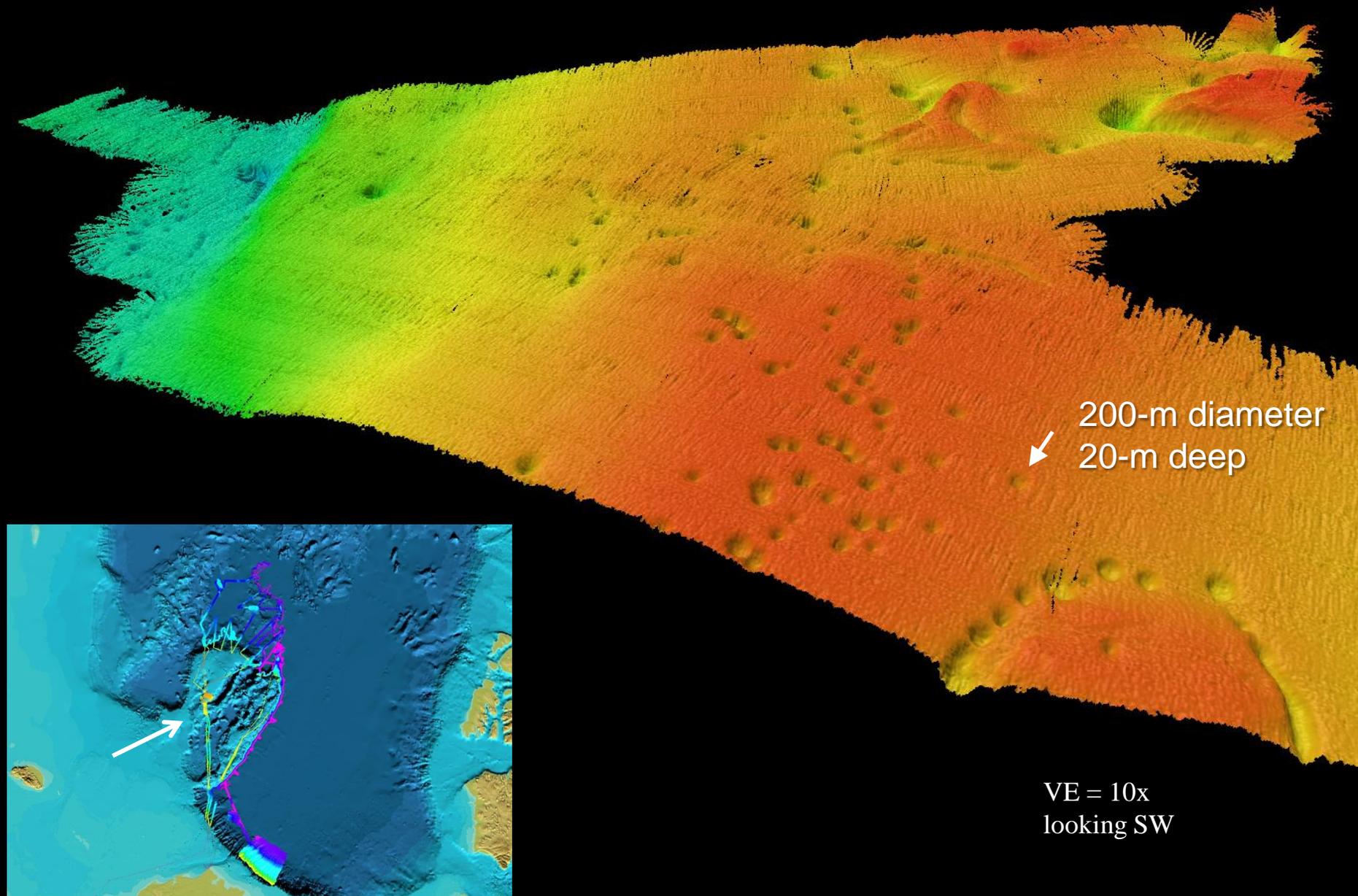




Where we thought Foot of Slope was

Where we now believe it is

# central Chukchi Plateau pockmarks





0 5 km

central Chukchi  
Plateau

3 to 5 m deep

ice grooves

-470 m

-380 m

bedforms

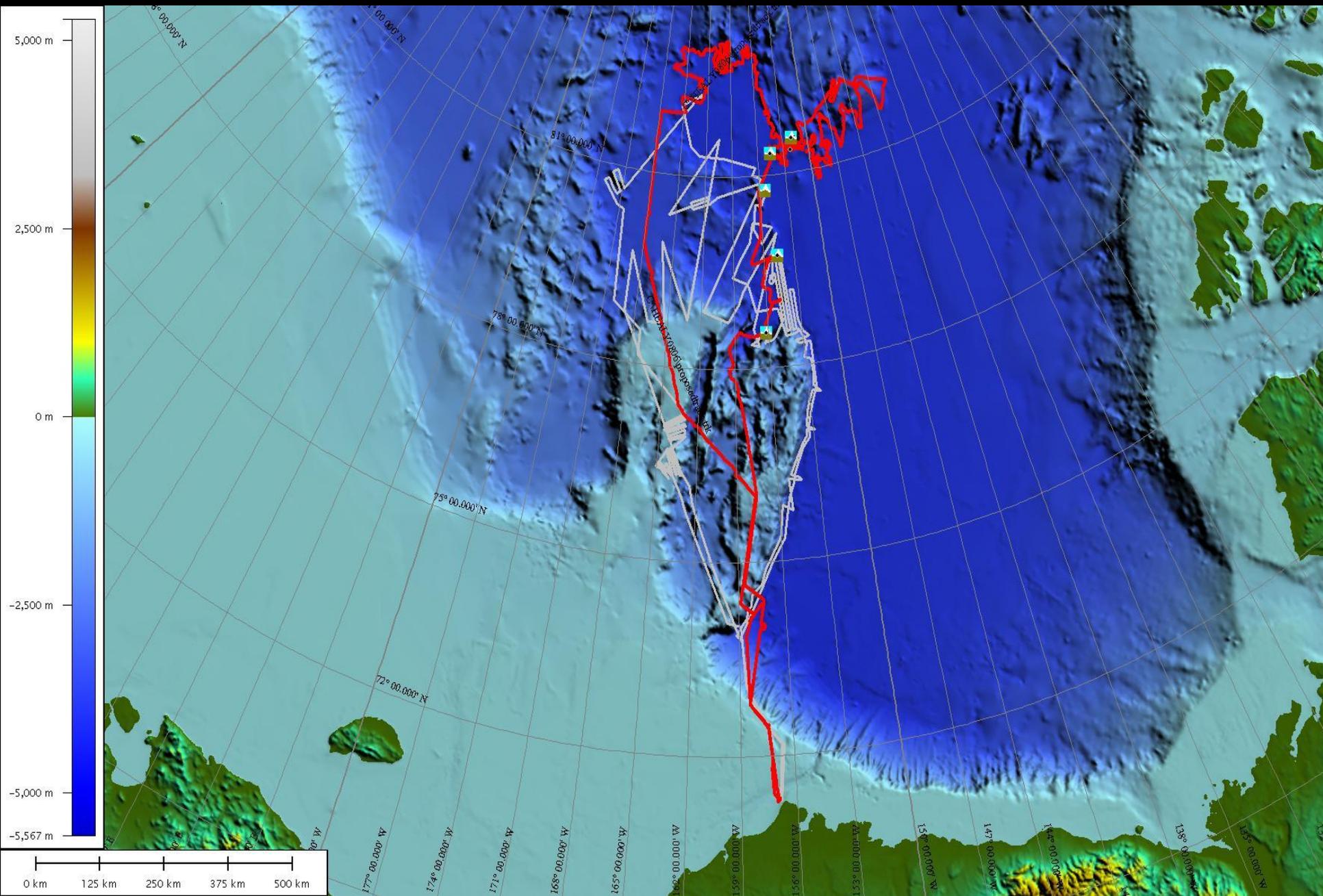
$\lambda = \sim 2$  km  
 $H = \sim 10$  m



# Annual Sea Ice Minimum



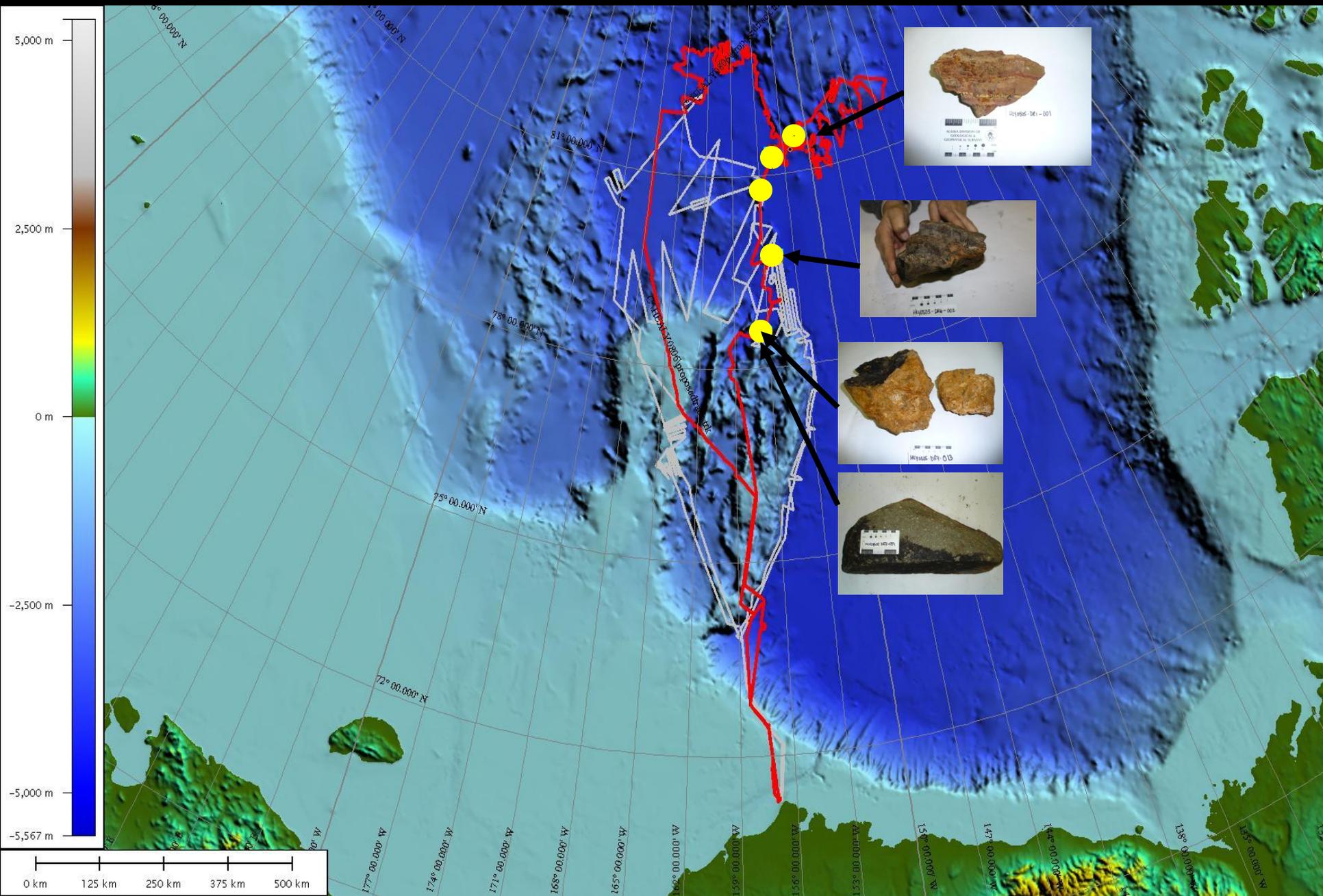
# HEALY 0805 – SHIPTRACK

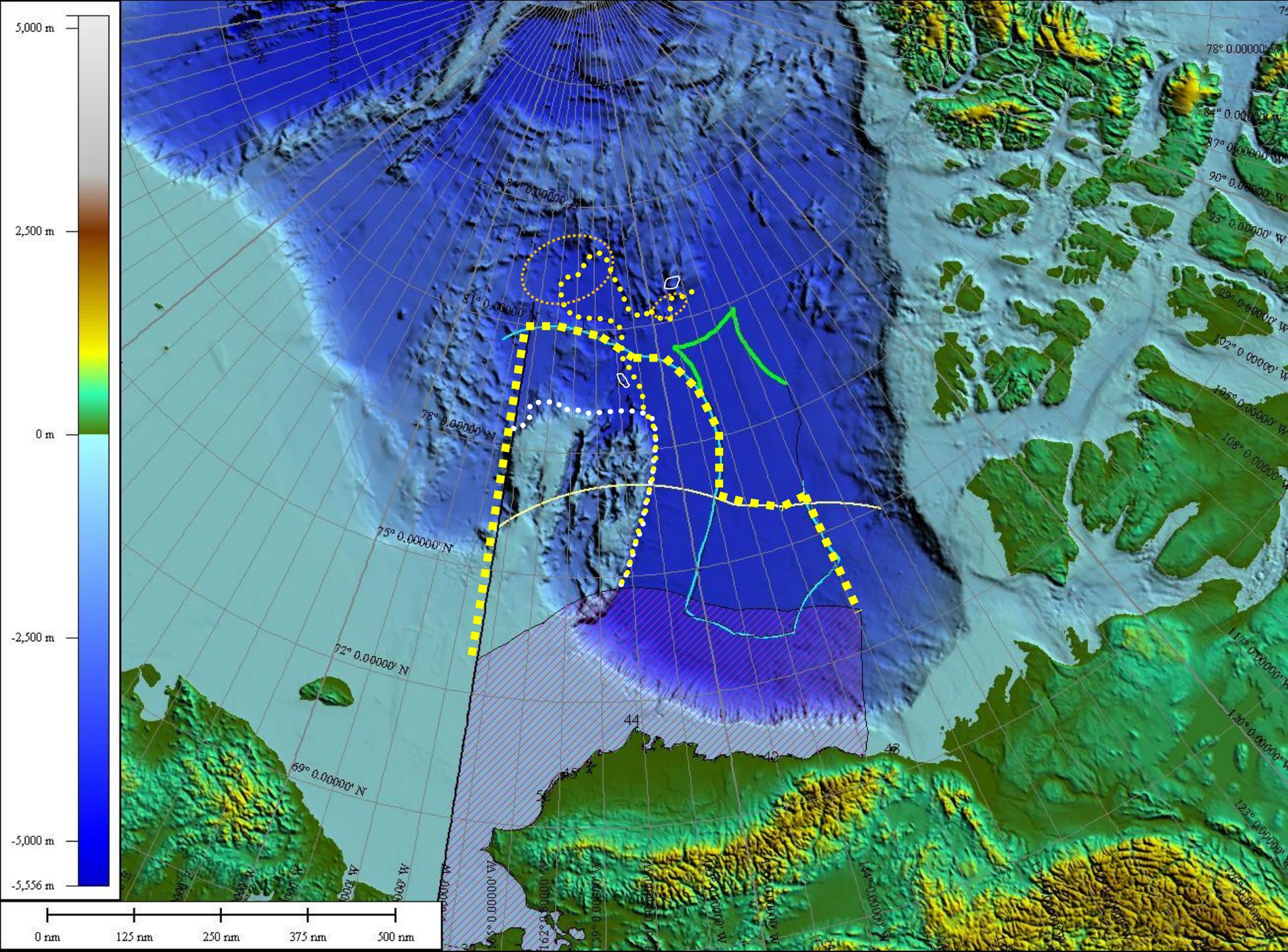


# DREDGING IN THE ICE

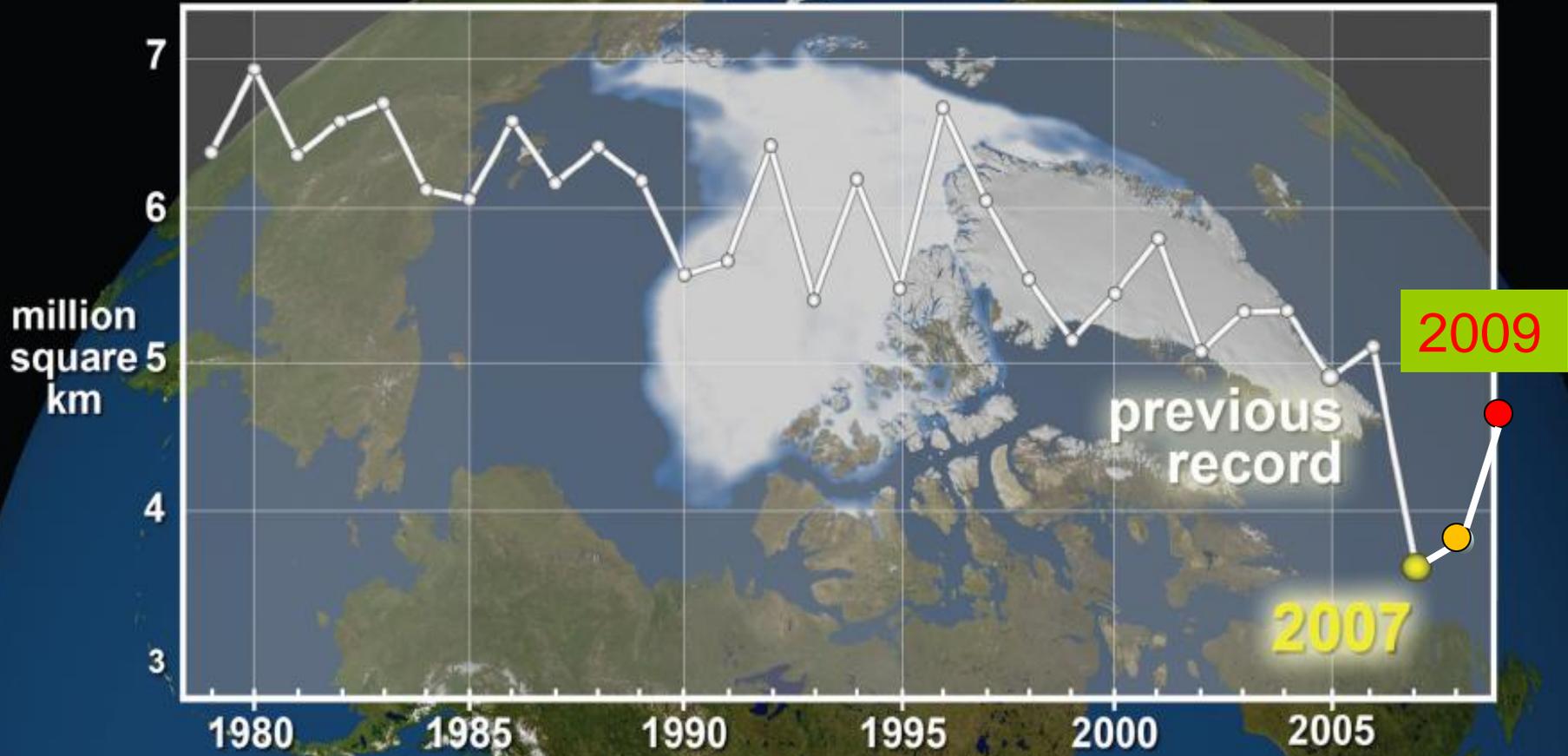


# HEALY 0805 – SHIPTRACK AND DREDGE SITES





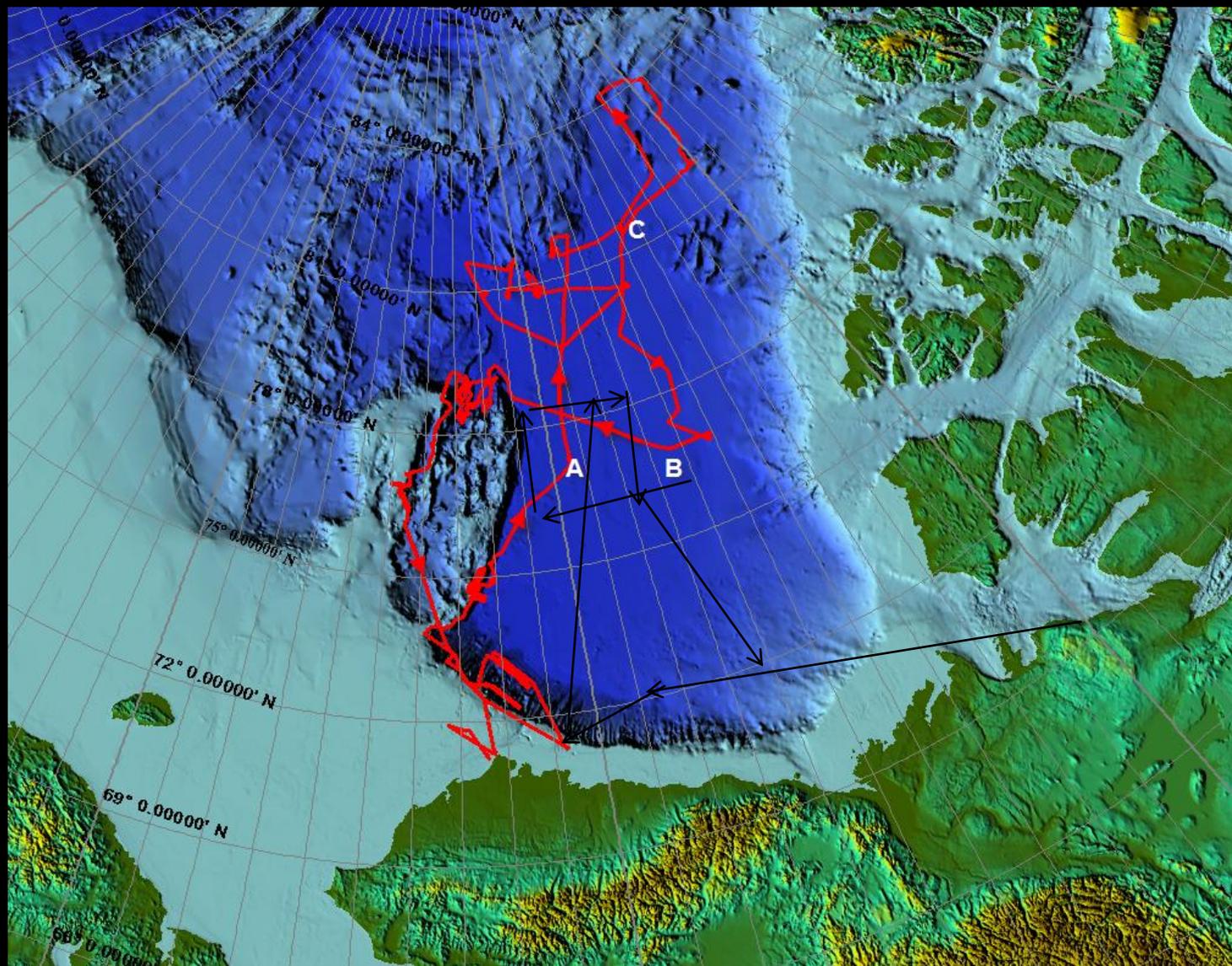
# Annual Sea Ice Minimum



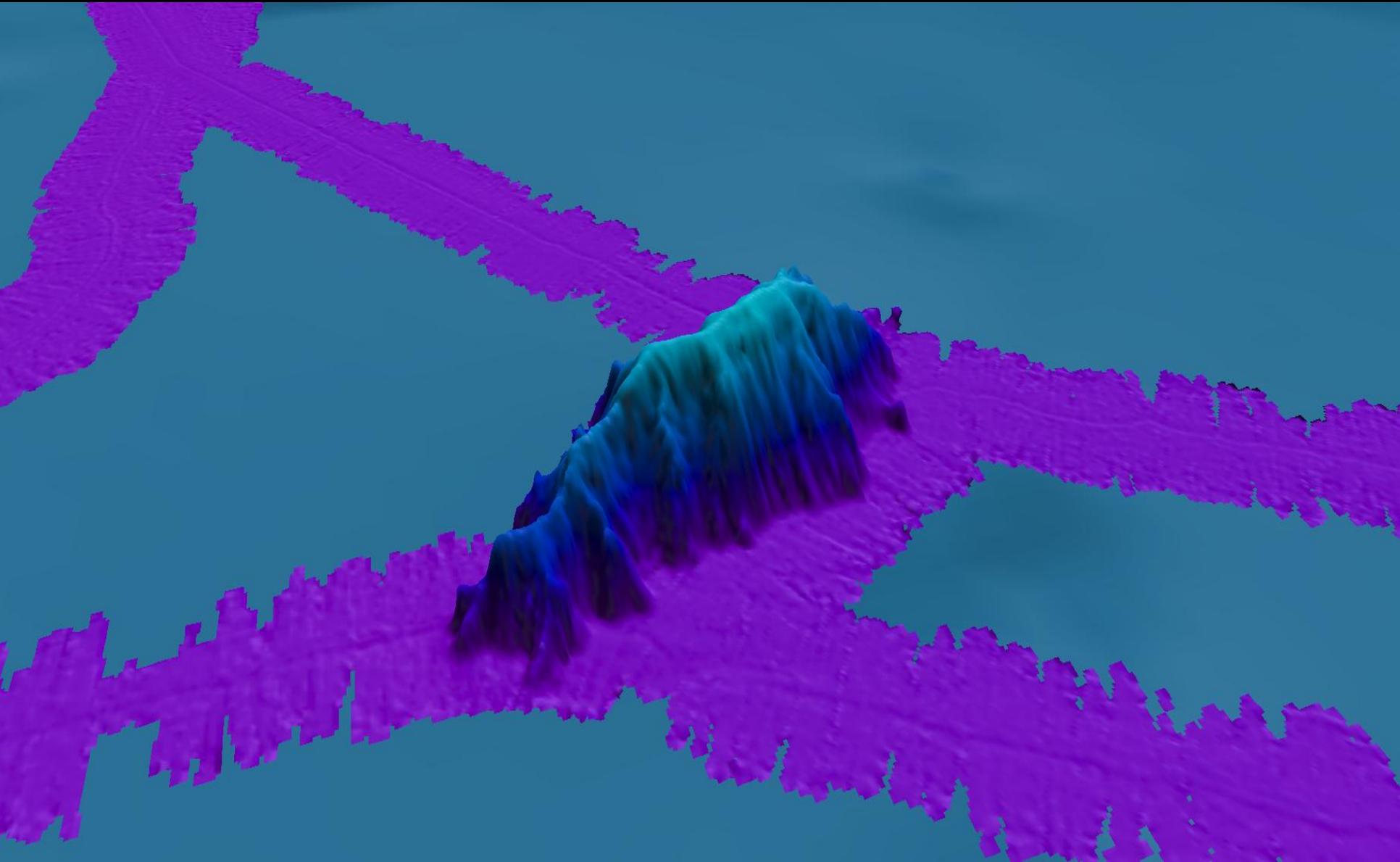
# HEALY 0905 - JOINT CANADIAN/U.S. PROGRAM - FOCUS ON SEISMIC



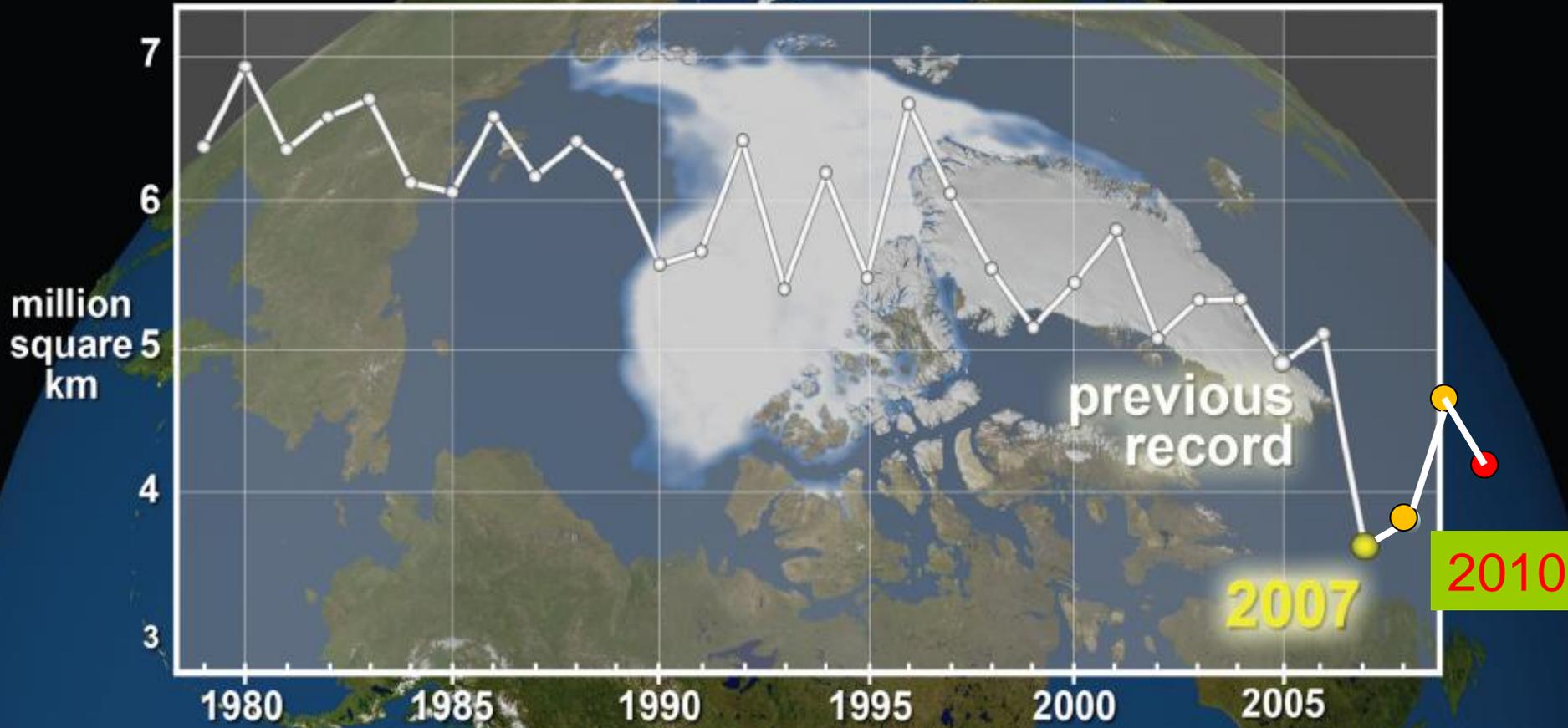
# HEALY 0905



# New Seamount: Savaqatigiit Seamount



# Annual Sea Ice Minimum



# HEALY 1002 - Again - Joint with LSSL - seismic

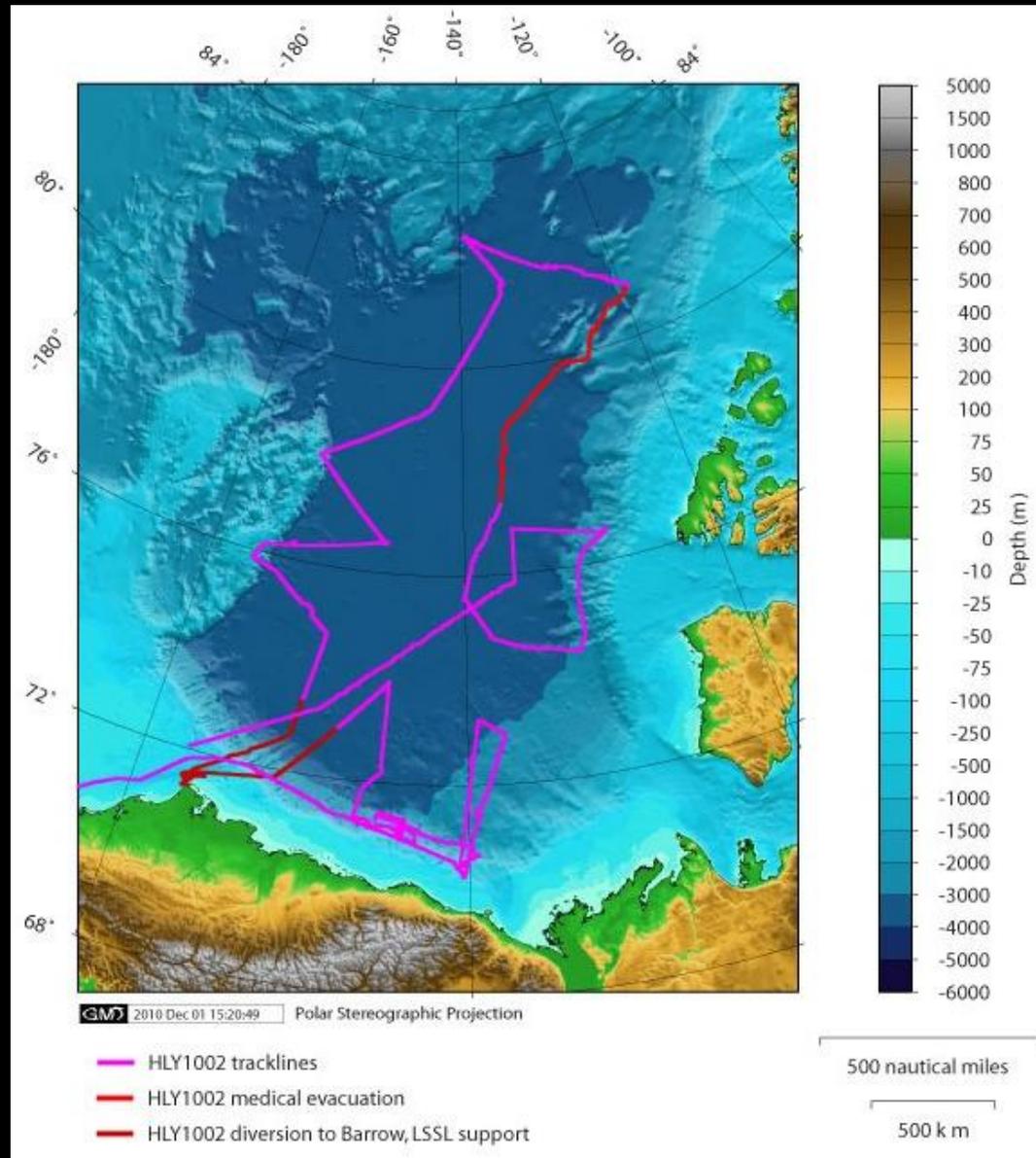


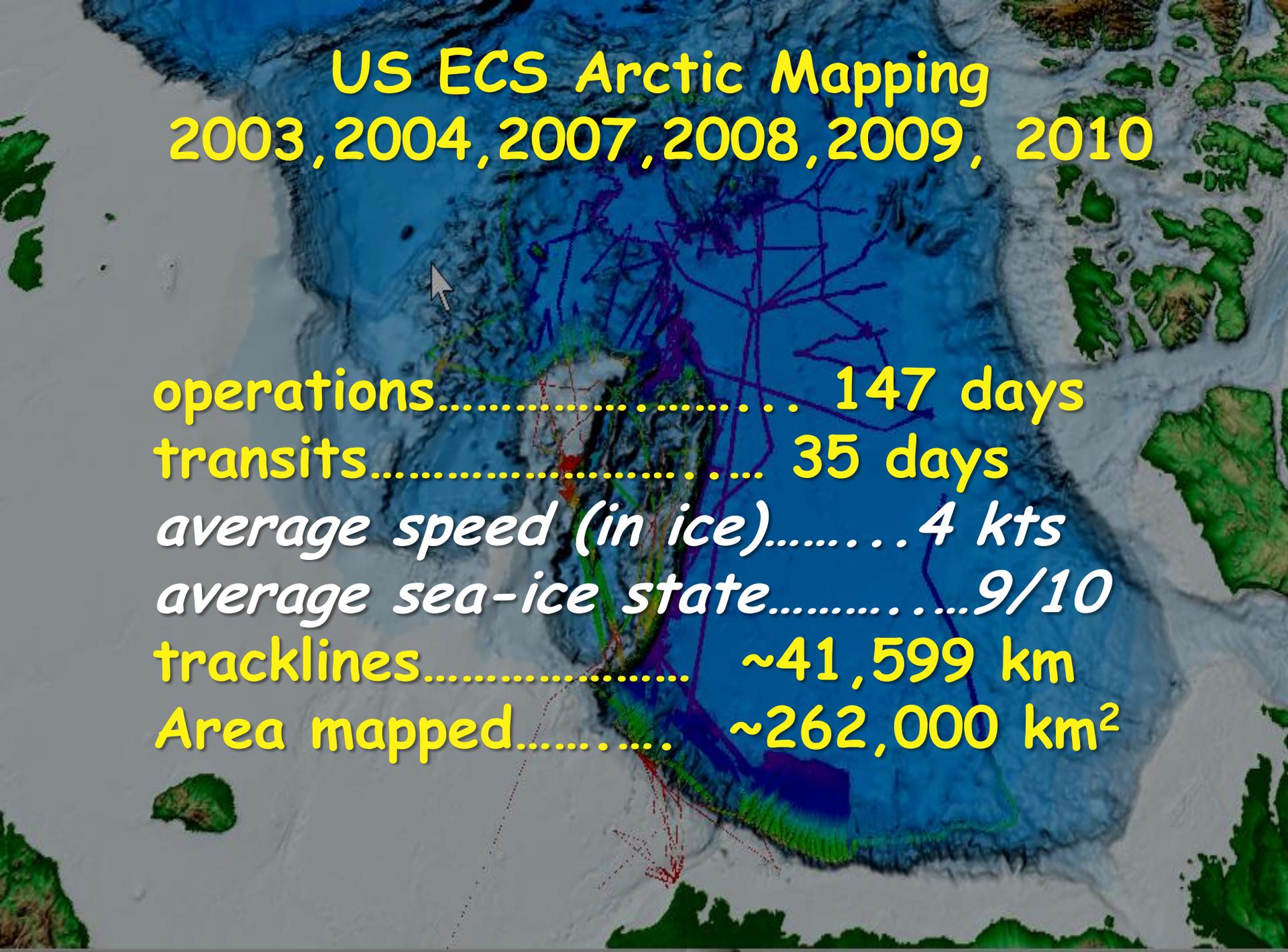
CCGS Louis S. St-Laurent



USCGC Healy

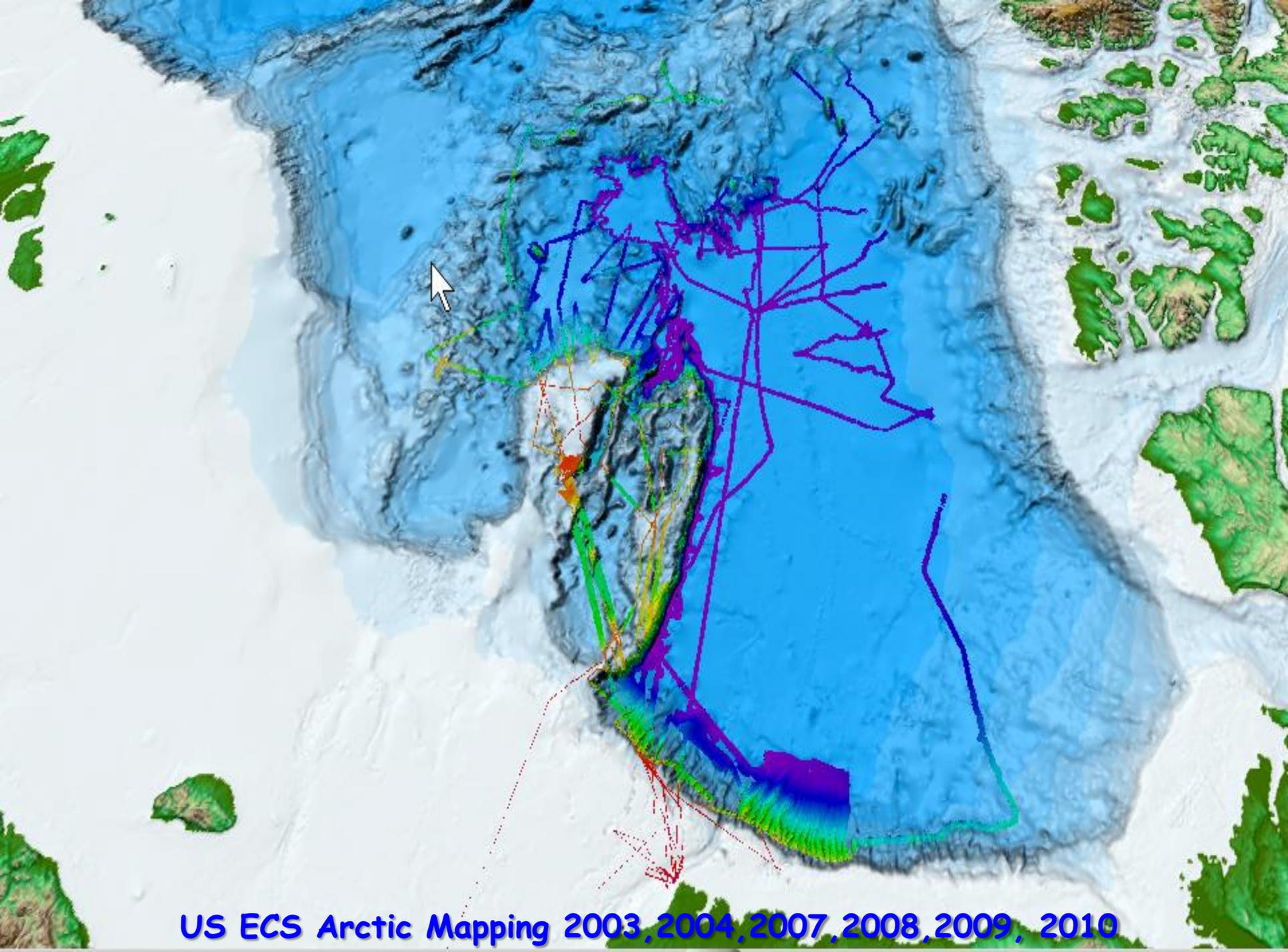
# HEALY 1002





# 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 km<sup>2</sup>



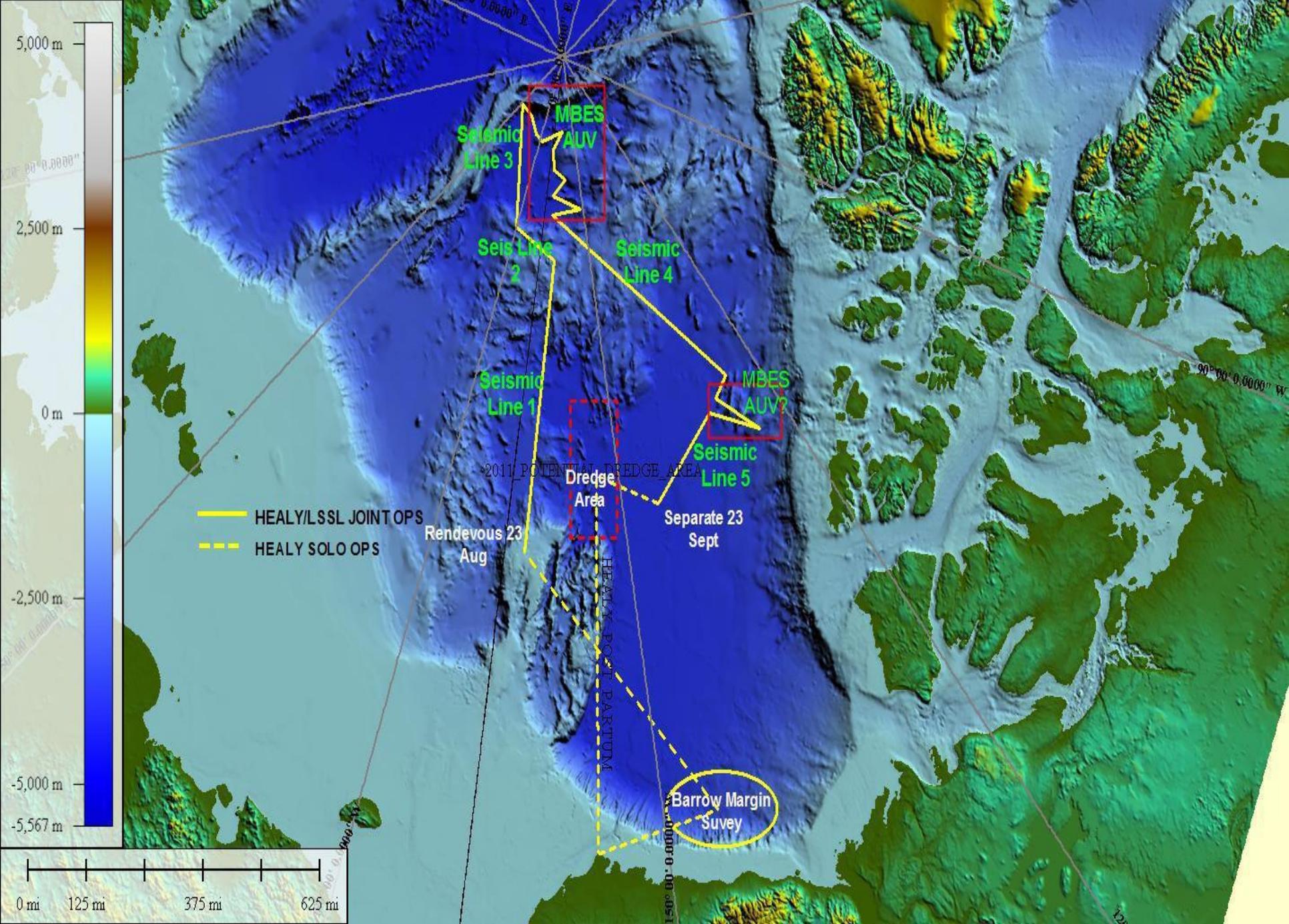
US ECS Arctic Mapping 2003, 2004, 2007, 2008, 2009, 2010

# HEALY 1102

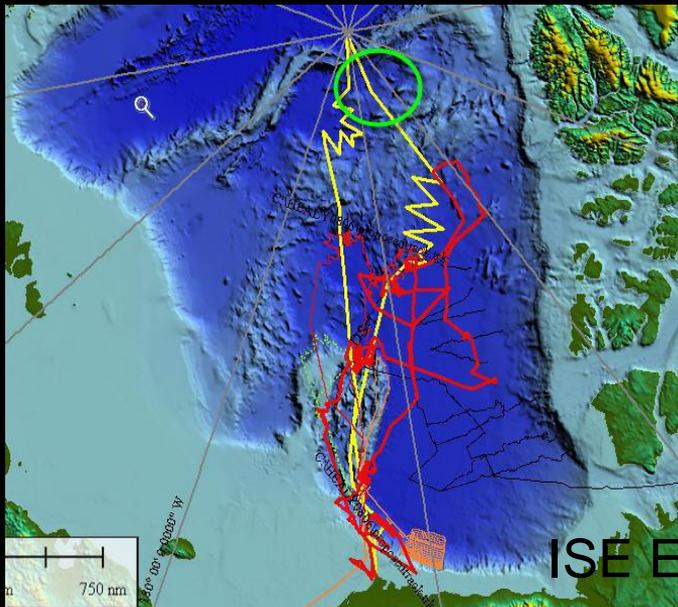
USCGC Healy

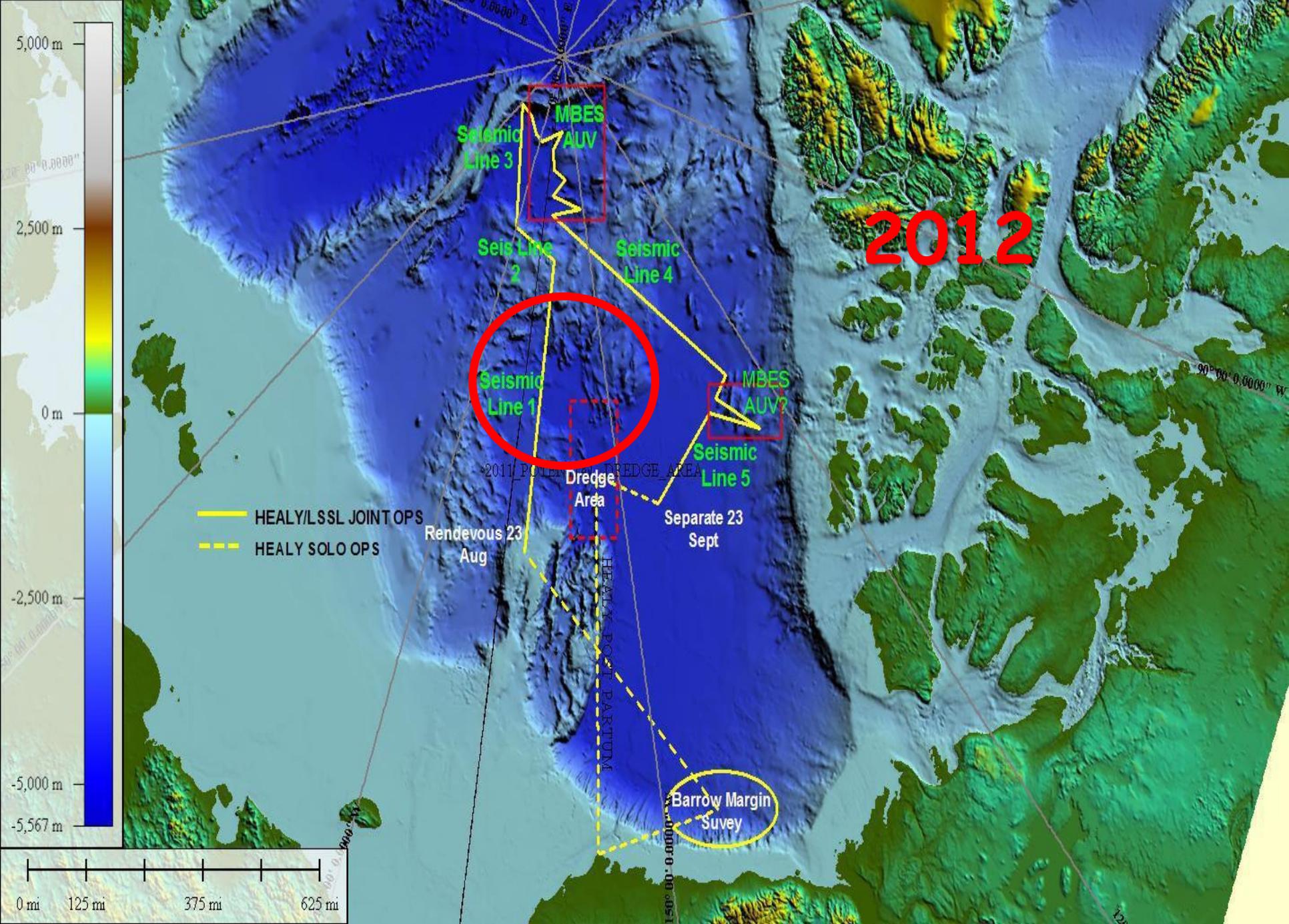
CCGS Louis S. St-Laurent





# 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**  
A Center for Expertise in Ocean Mapping and Hydrographic Sciences

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## Law of the Sea Mapping Program

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

Mendocino

### 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  
 backscatter  
 HE0905 North bathy  
 HE0806 North bathy  
 HE0806 North bathy  
 backscatter  
 HE0805 North bathy  
 HE0805 North bathy  
 backscatter

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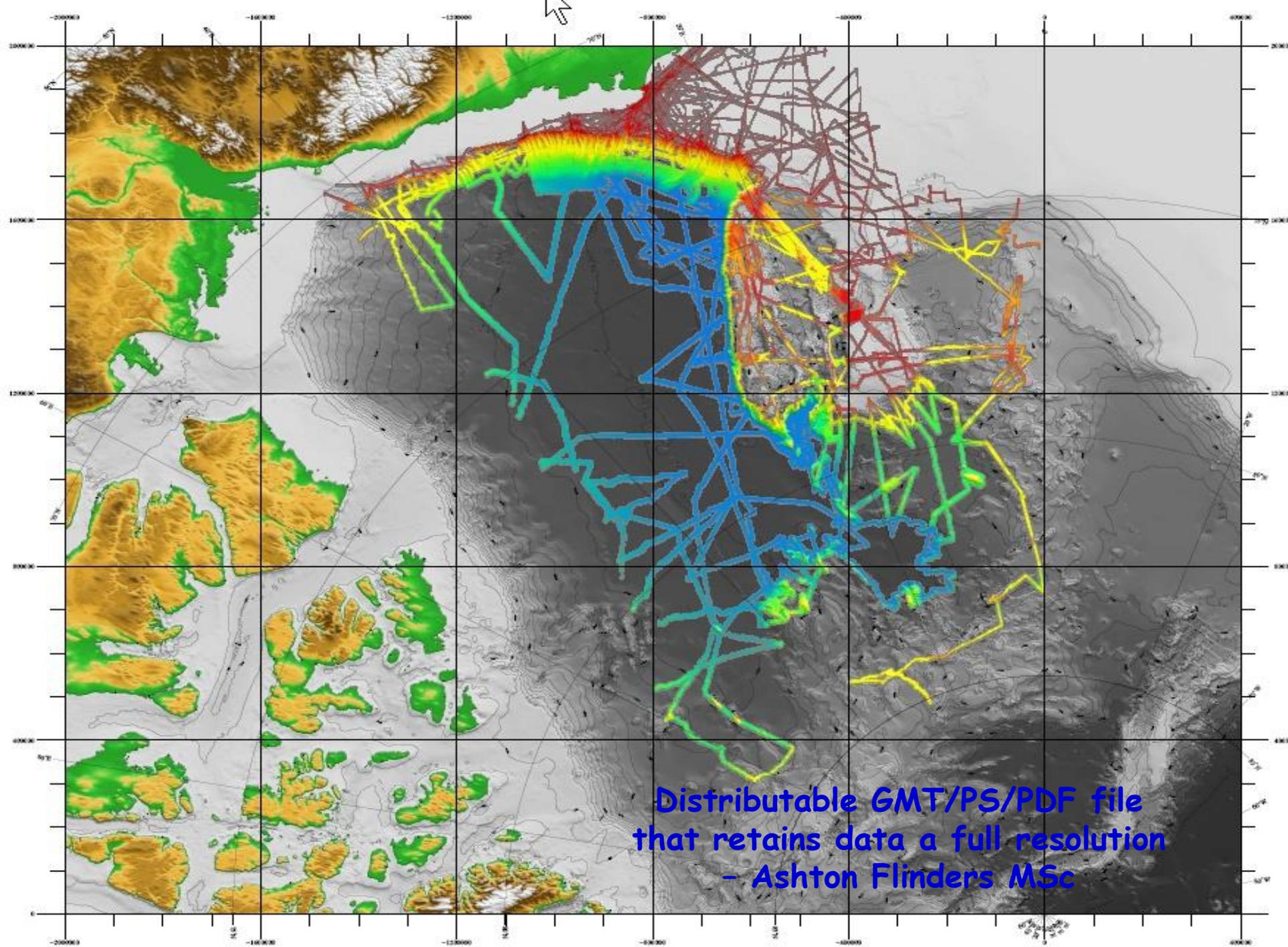
Natural Hazards

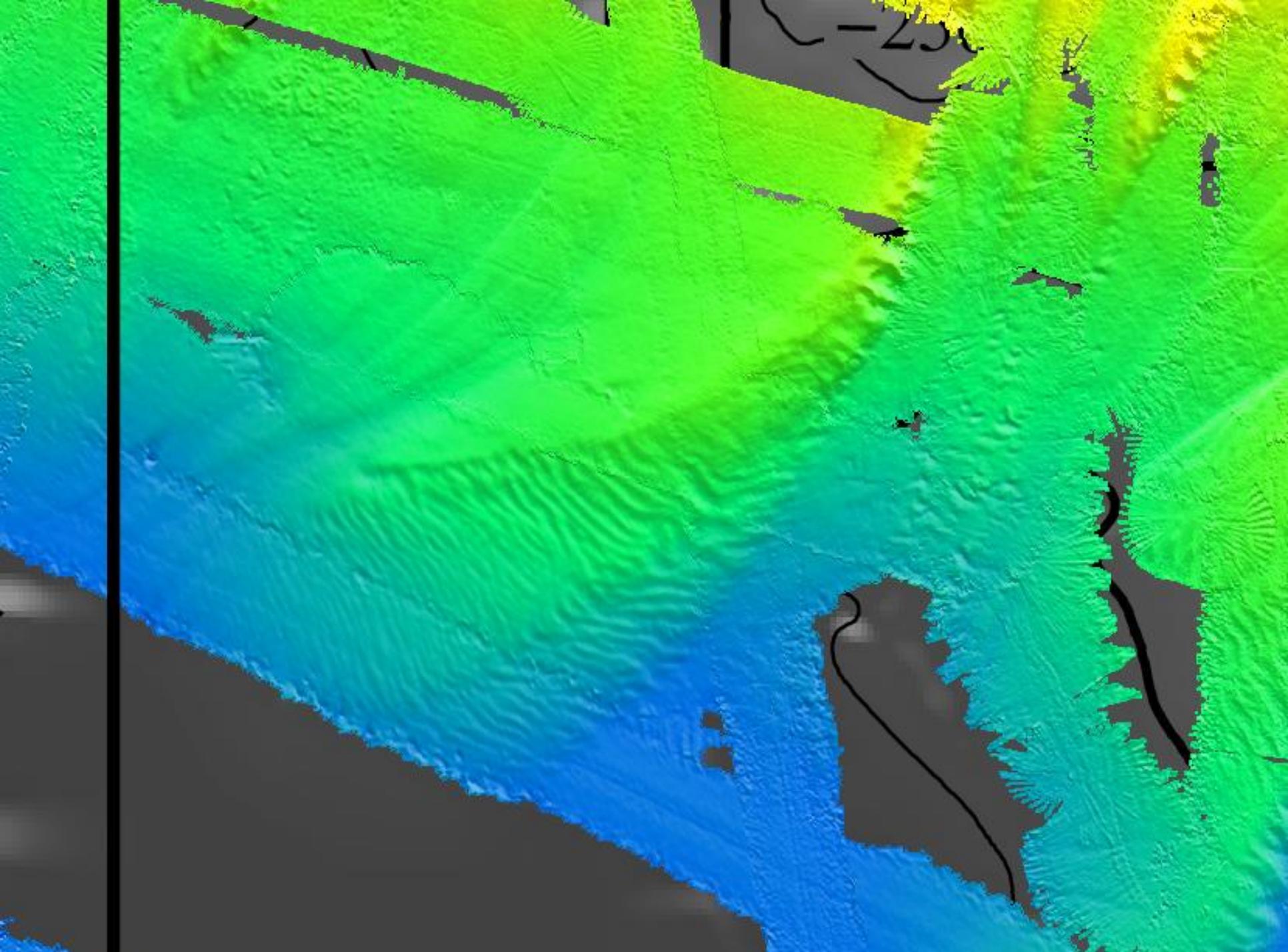
Marine Geology & Geophysics

**R**  
Rolling Deck Repository



Bathymetry  
& Global Relief







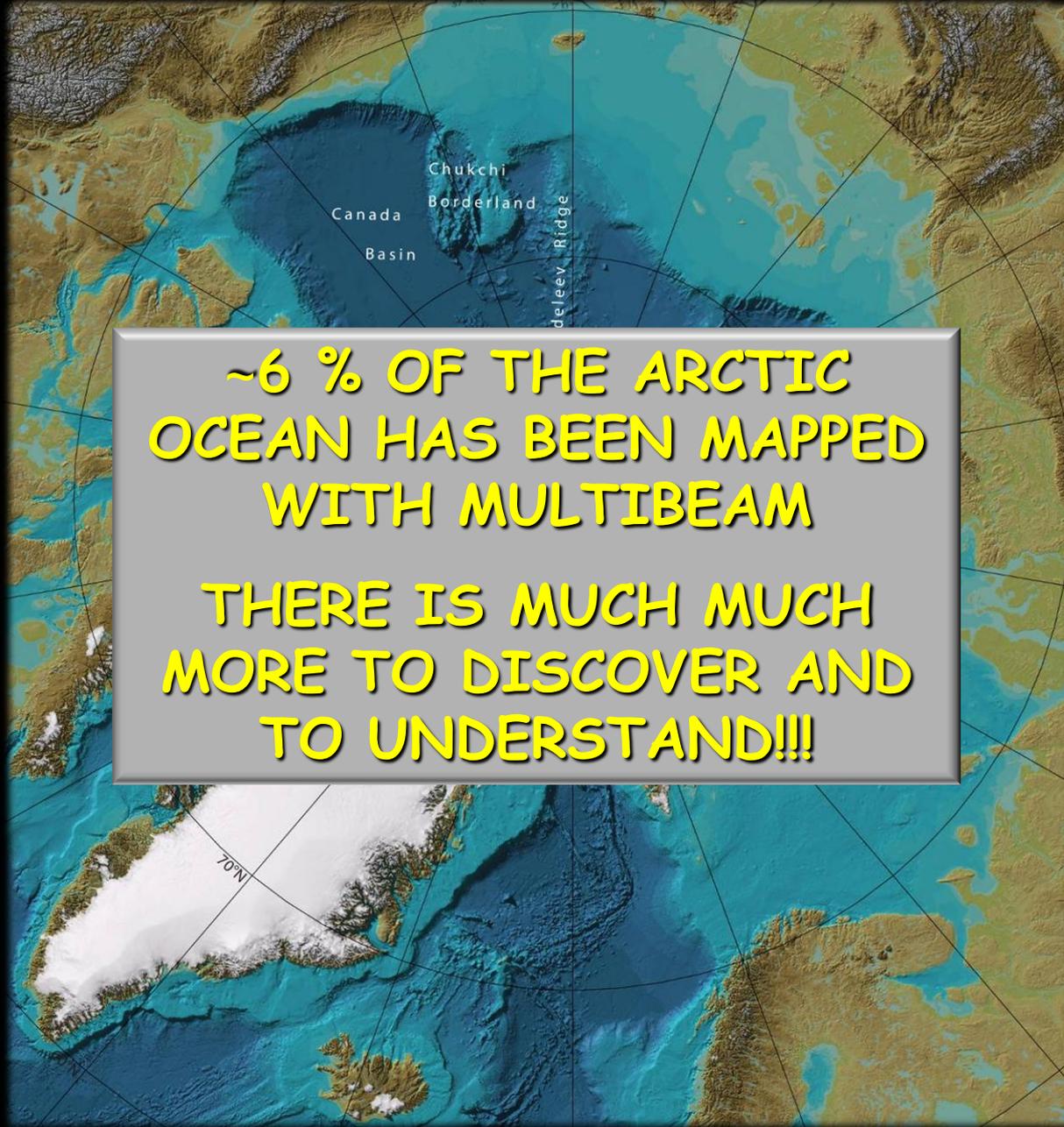
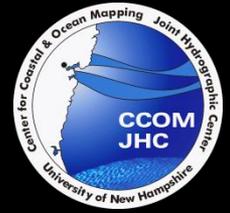
# CHALLENGES

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.”