The Continental Shelf and Changing Sea Level

Larry Mayer

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Maritime Boundary Diplomacy Bali, Indonesai 24 June 2011

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

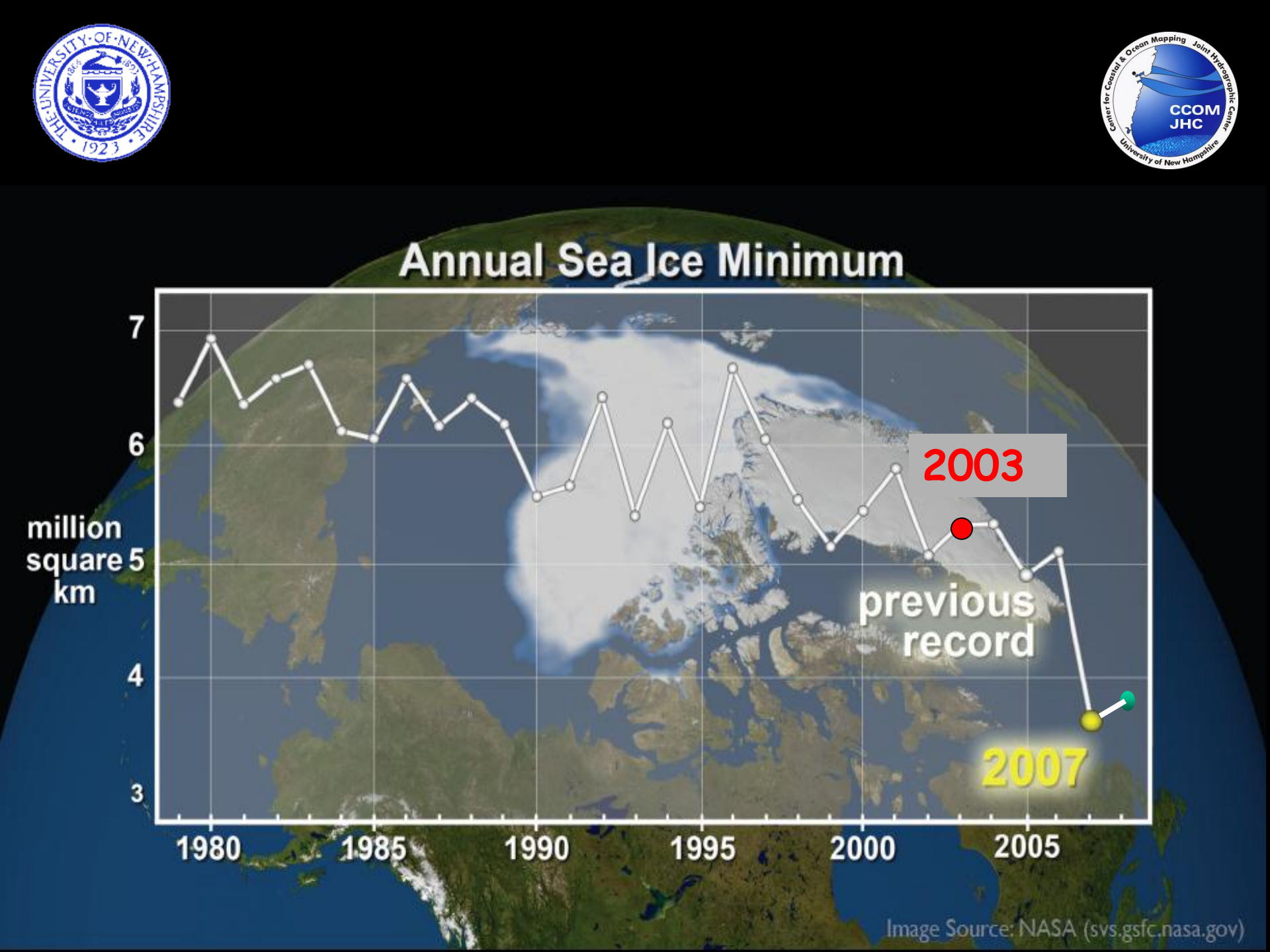
Annual Sea Ice Minimum
7
6
5
4
3
million square km
1980
1985
1990
1995
2000
2005
2003
previous record
2007
Image Source: NASA (svs.gsfc.nasa.gov)

Photo from M. Jakobsson

Annual Sea Ice Minimum
7
6
5
4
3
million square km
1980
1985
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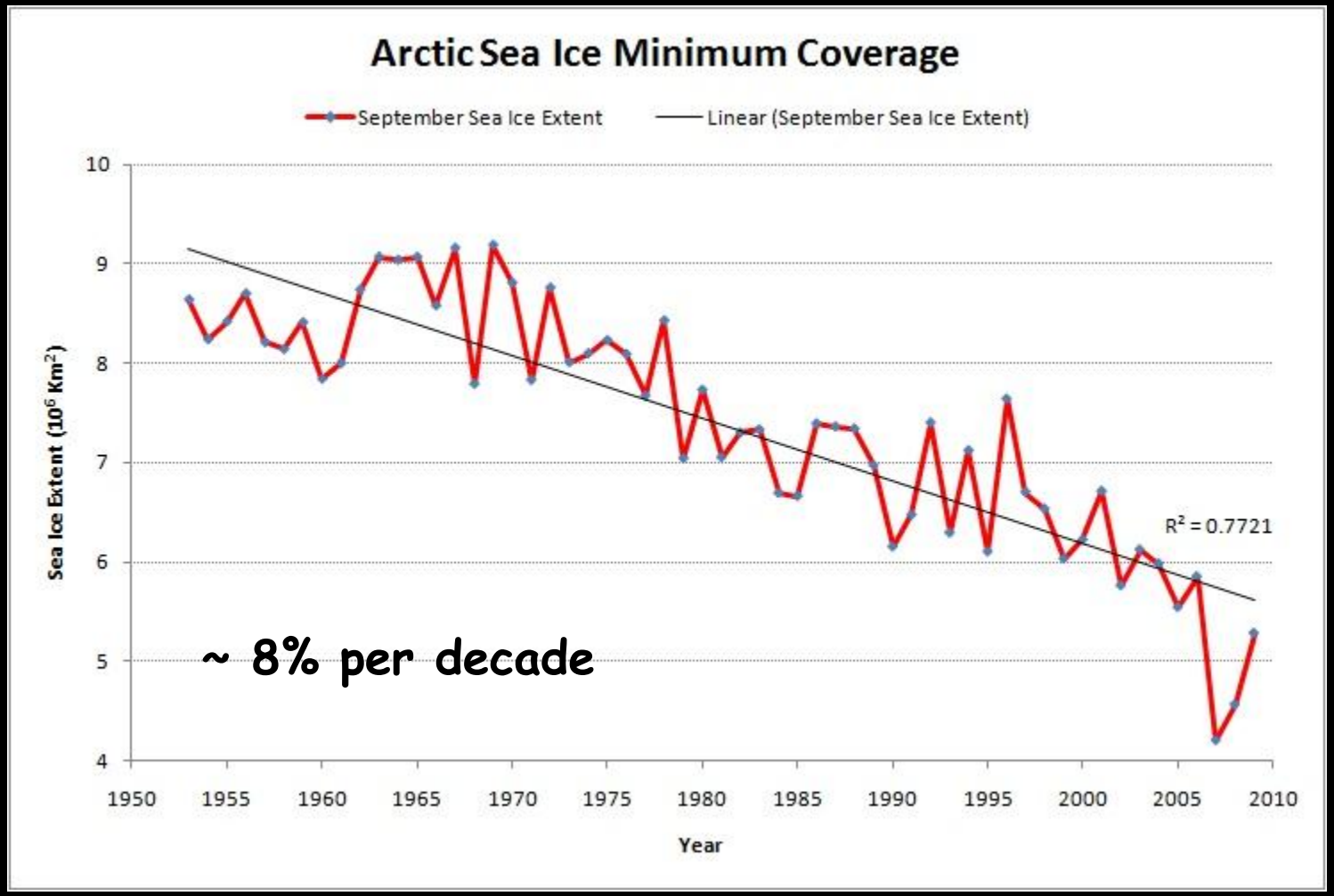
2007
Image Source: NASA (svs.gsfc.nasa.gov)



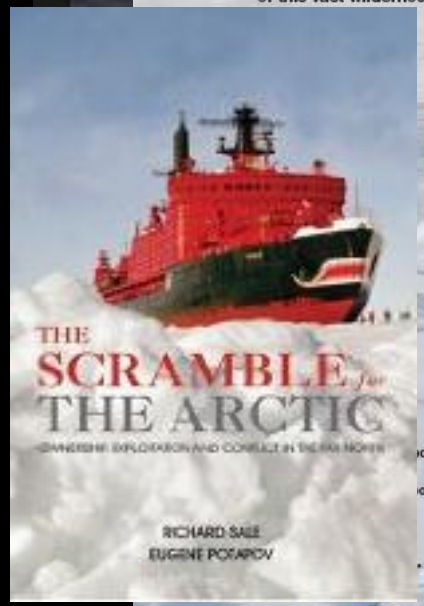
http://www.skepticalscience.com/Has-Arctic-sea-ice-recovered.htm

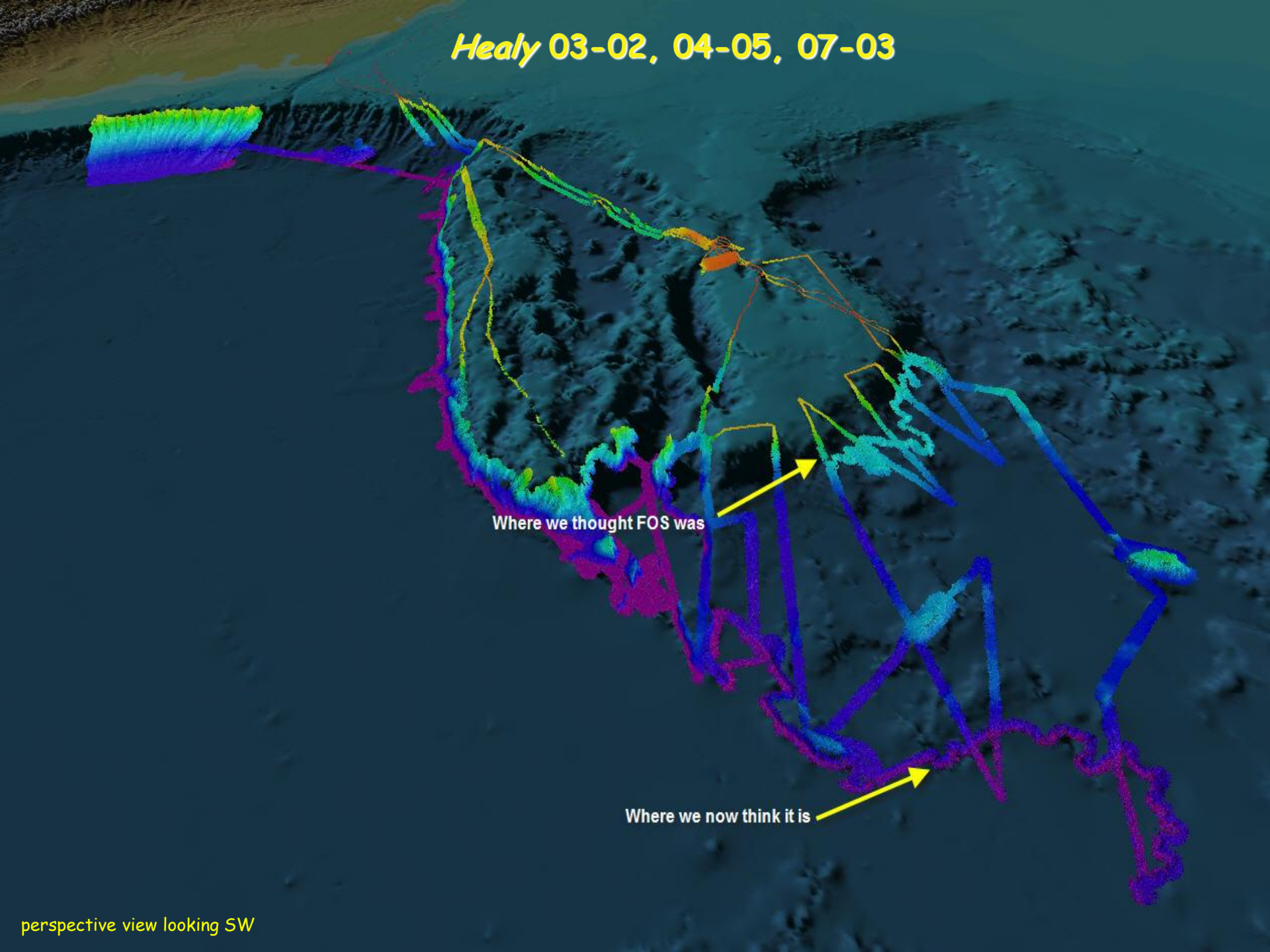
TIME

NATIONAL GEOGRAPHIC™

ARCTIC LANDGRAB

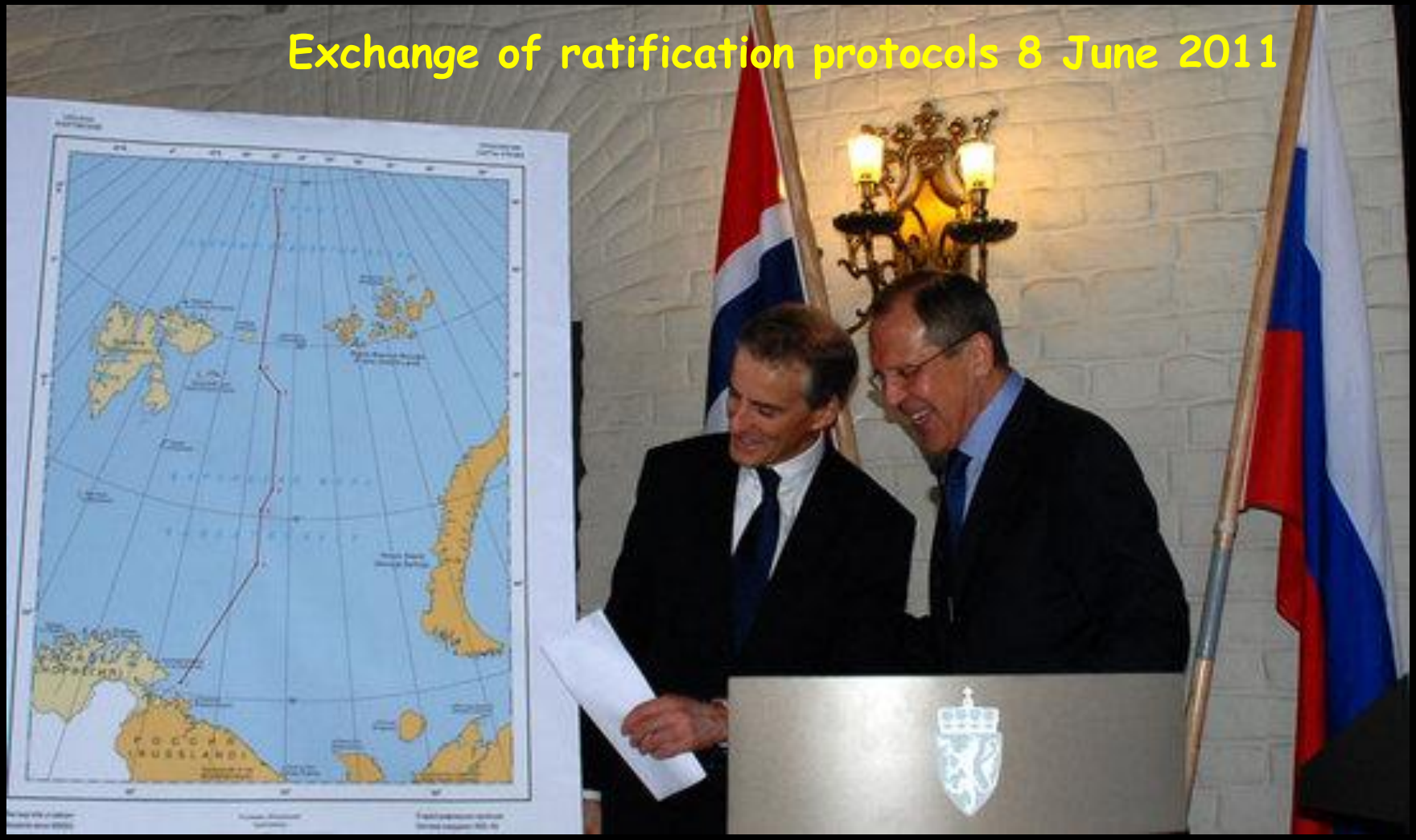
As rising temperatures melt the polar ice cap, five countries race to map their claims to a new energy frontier. The stakes are huge. Nearly a quarter of the world's undiscovered oil and gas may lie beneath the seabed of this vast wilderness.



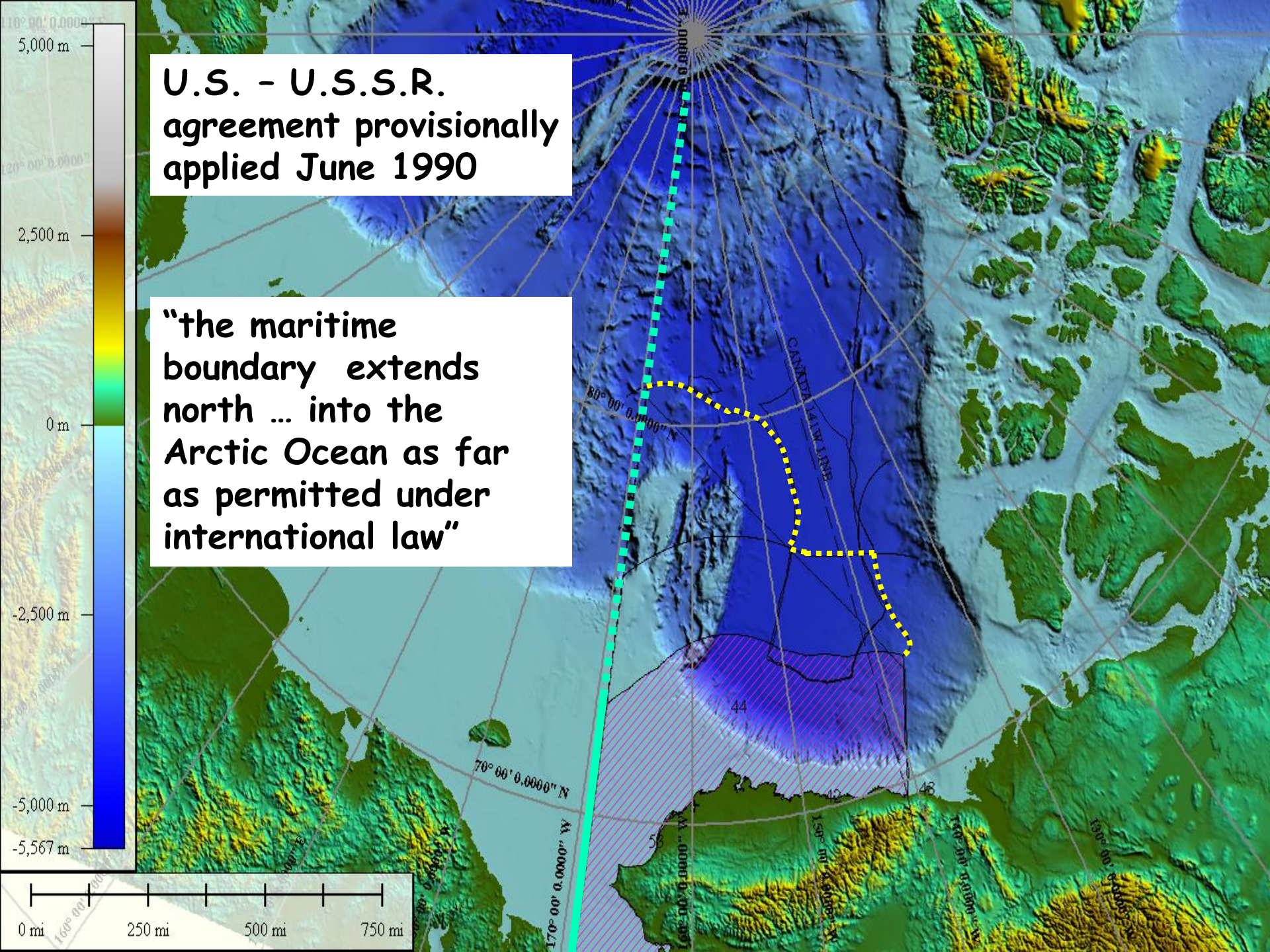

Healy 03-02, 04-05, 07-03
Where we thought FOS was
Where we now think it is
perspective view looking SW

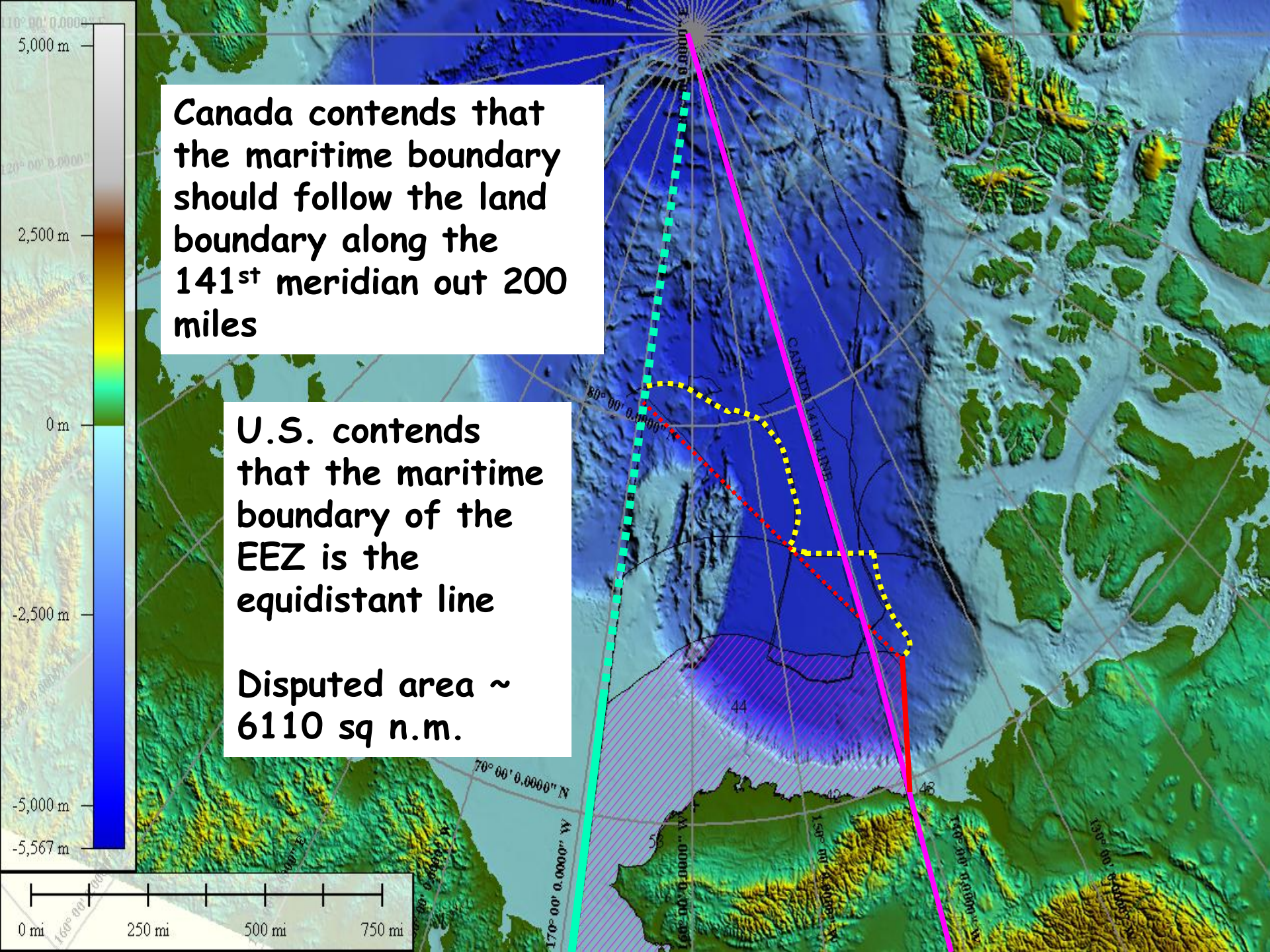
‘Historic’ Norwegian-Russian treaty signed in Murmansk

Published on Wednesday, 15th September, 2010 at 20:38 under the news category, by Inez Dawczyk.



http://www.barentsobserver.com/the-new-norwegian-russian-border.4930280-116320.html


U.S. – U.S.S.R. agreement provisionally applied June 1990
"the maritime boundary extends north … into the Arctic Ocean as far as permitted under international law"
5,000 m
2,500 m
0 m
-2,500 m
-5,000 m
-5,567 m
0 mi
250 mi
500 mi
750 mi
80° 00' 0.0000" N
70° 00' 0.0000" N
170° 00' 0.0000" W
44
42
43



Canada contends that the maritime boundary should follow the land boundary along the 141st meridian out 200 miles

U.S. contends that the maritime boundary of the EEZ is the equidistant line

Disputed area ~ 6110 sq n.m.

Three joint missions with LSSL

CCGS Louis S. St-Laurent

USCGC Healy

Severe Coastal Erosion in Arctic

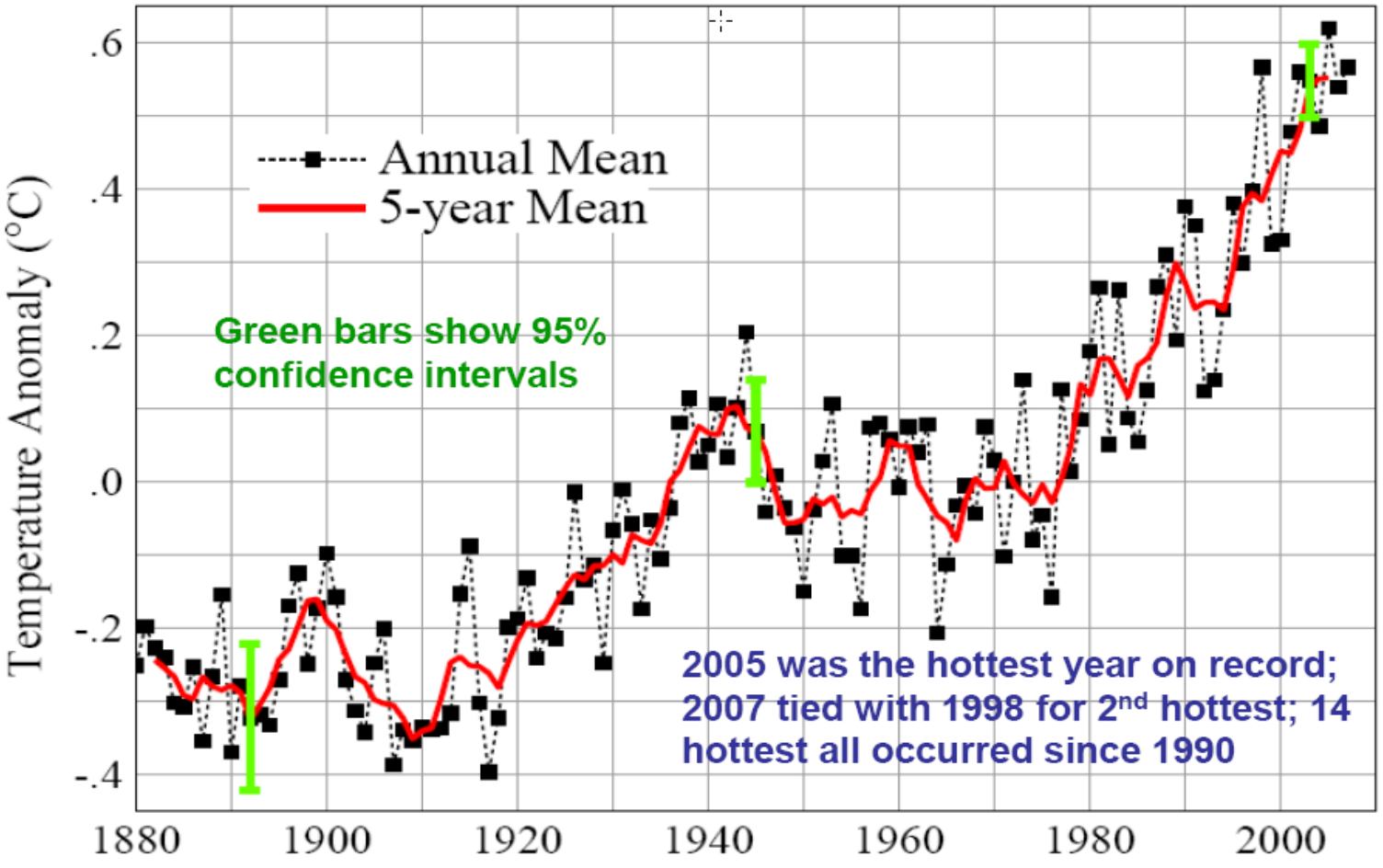
USGS / Gary D. Clow

http://coastalcare.org/2010/08/erosion-doubles-along-alaskas-arctic-coast/

Climate Change 2007: Synth

Instrumental Record

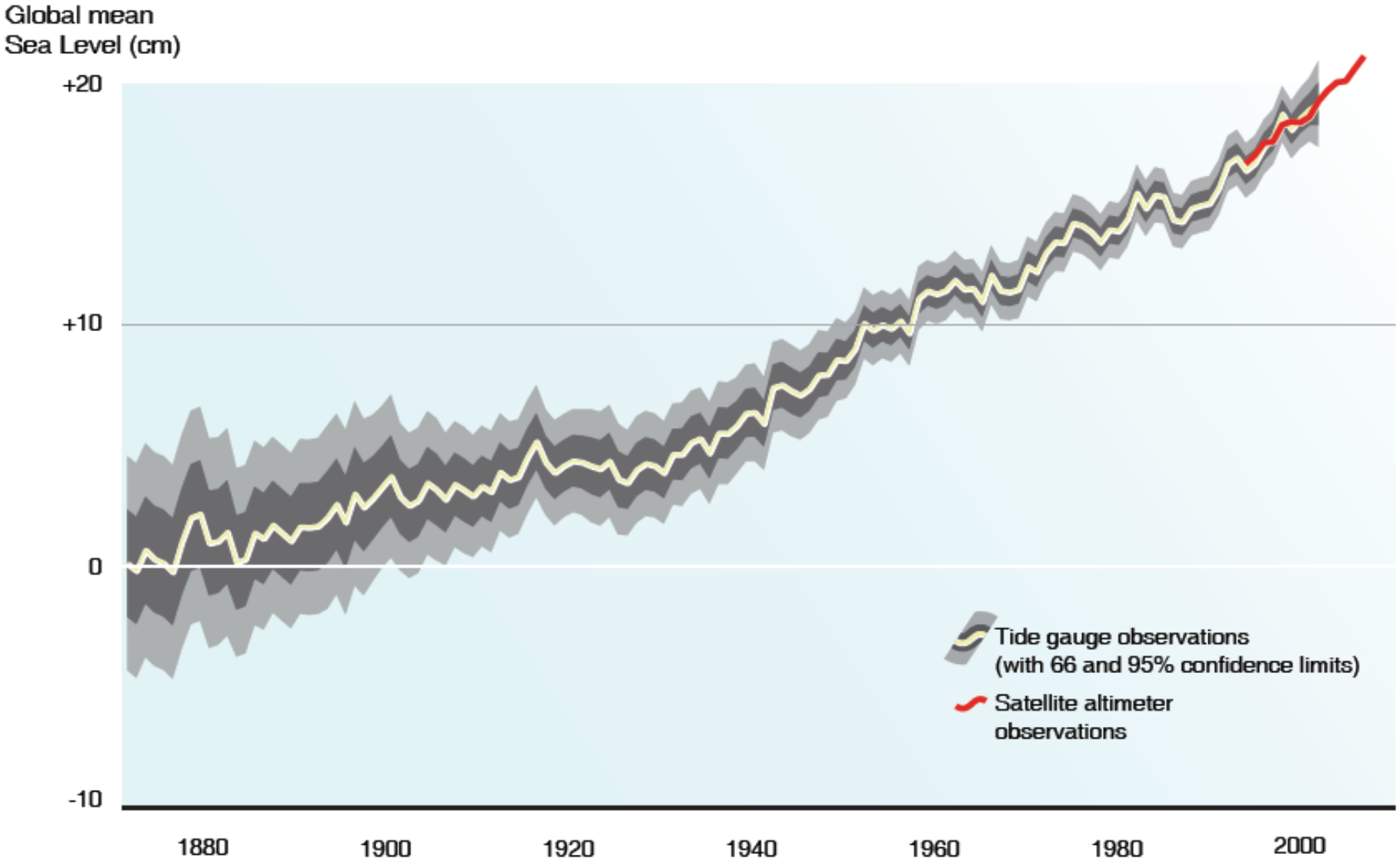
The Earth is getting hotter: the thermometer record



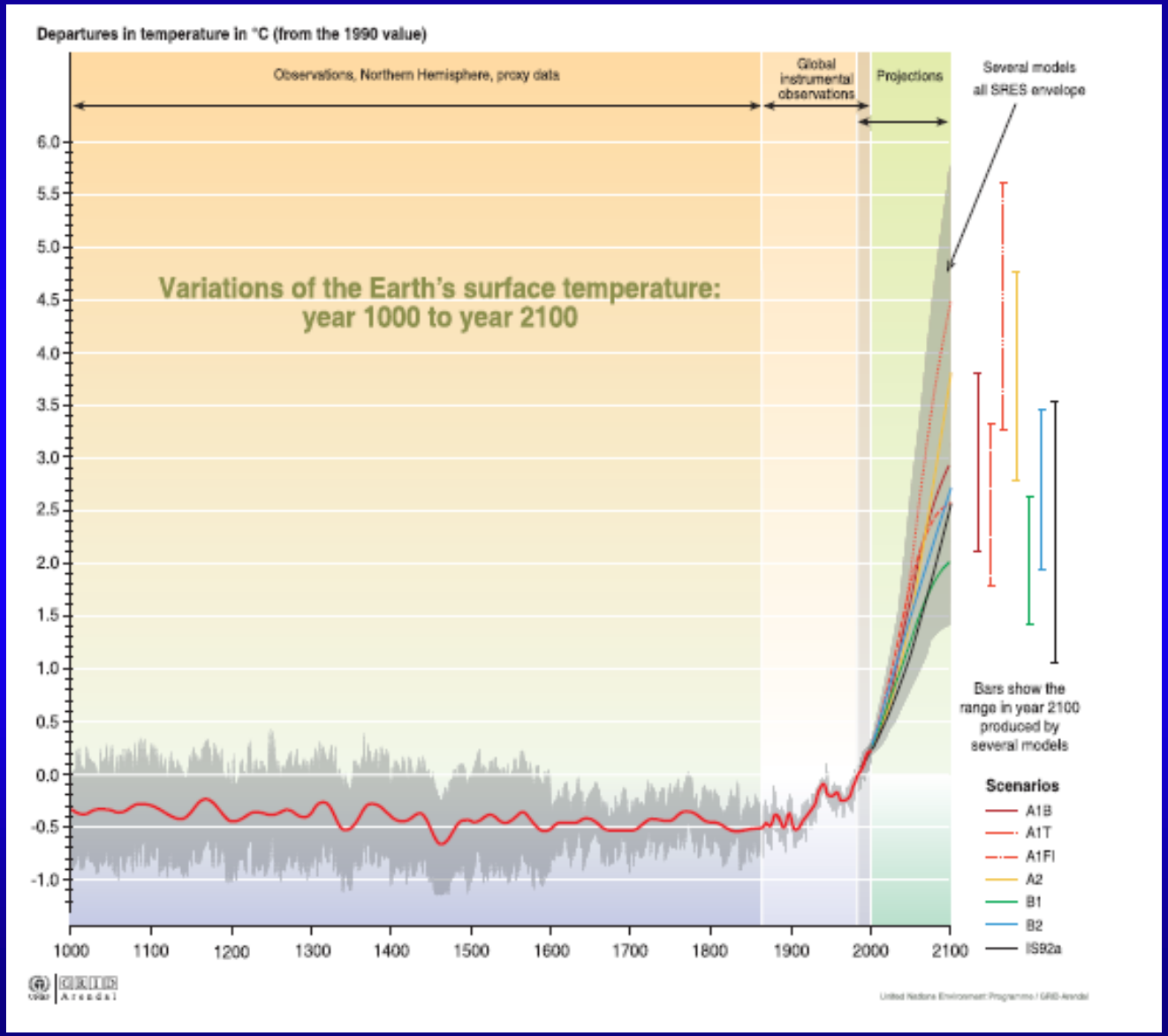
From John Holdren OSTP

http://data.giss.nasa.gov/gistemp/graphs/

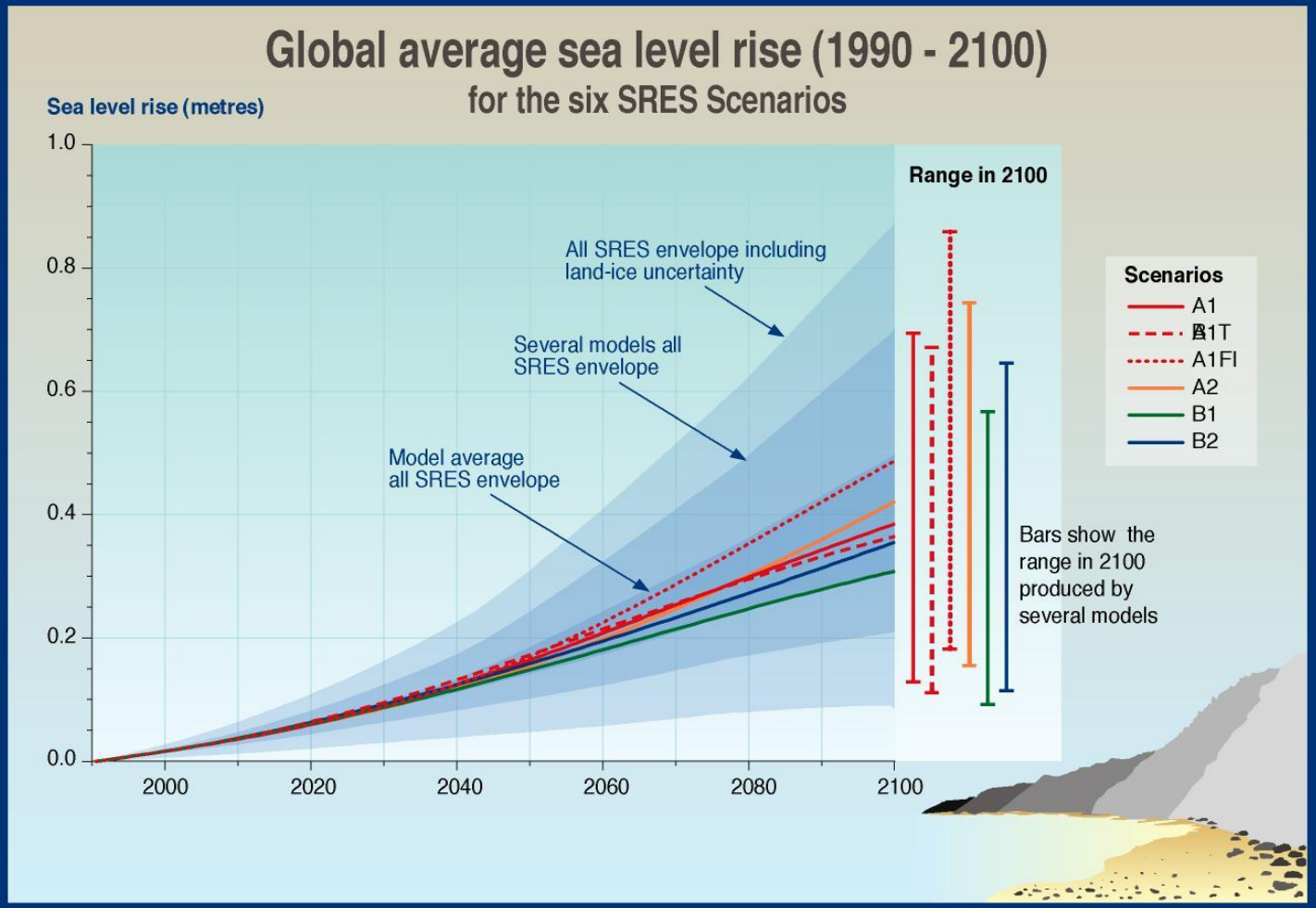
GLOBAL MEAN SEA LEVEL RISE



IPCC Predictions of Future Temperature

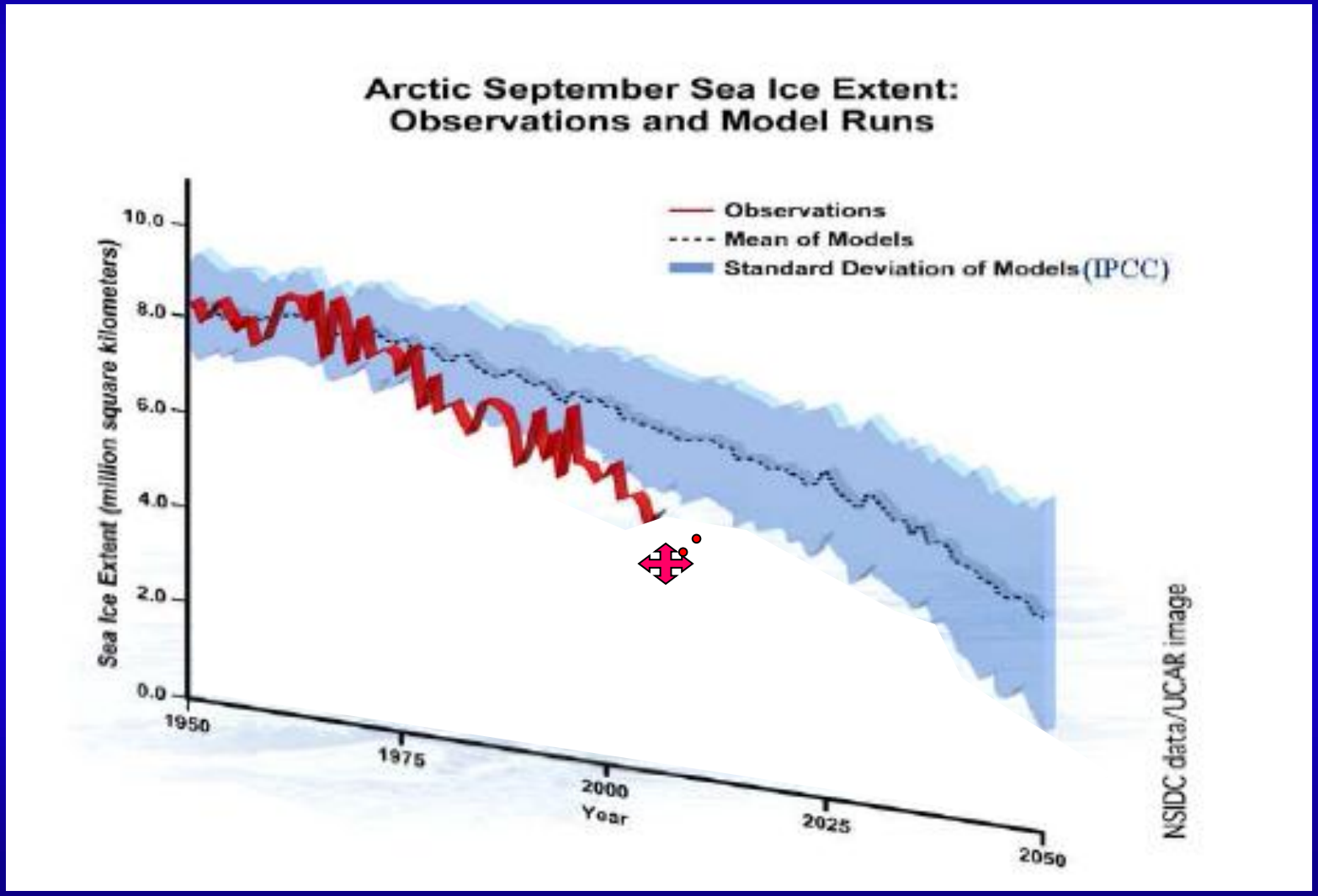


IPCC PREDICTED GLOBAL AVERAGE SEA LEVEL RISE



WG1 TS FIGURE 24

Sea Ice Models vs Observations



Potential impact of sea-level rise on Bangladesh

Today

Total population: 112 Million

Total land area: 134,000 km^2

1.5 m - Impact

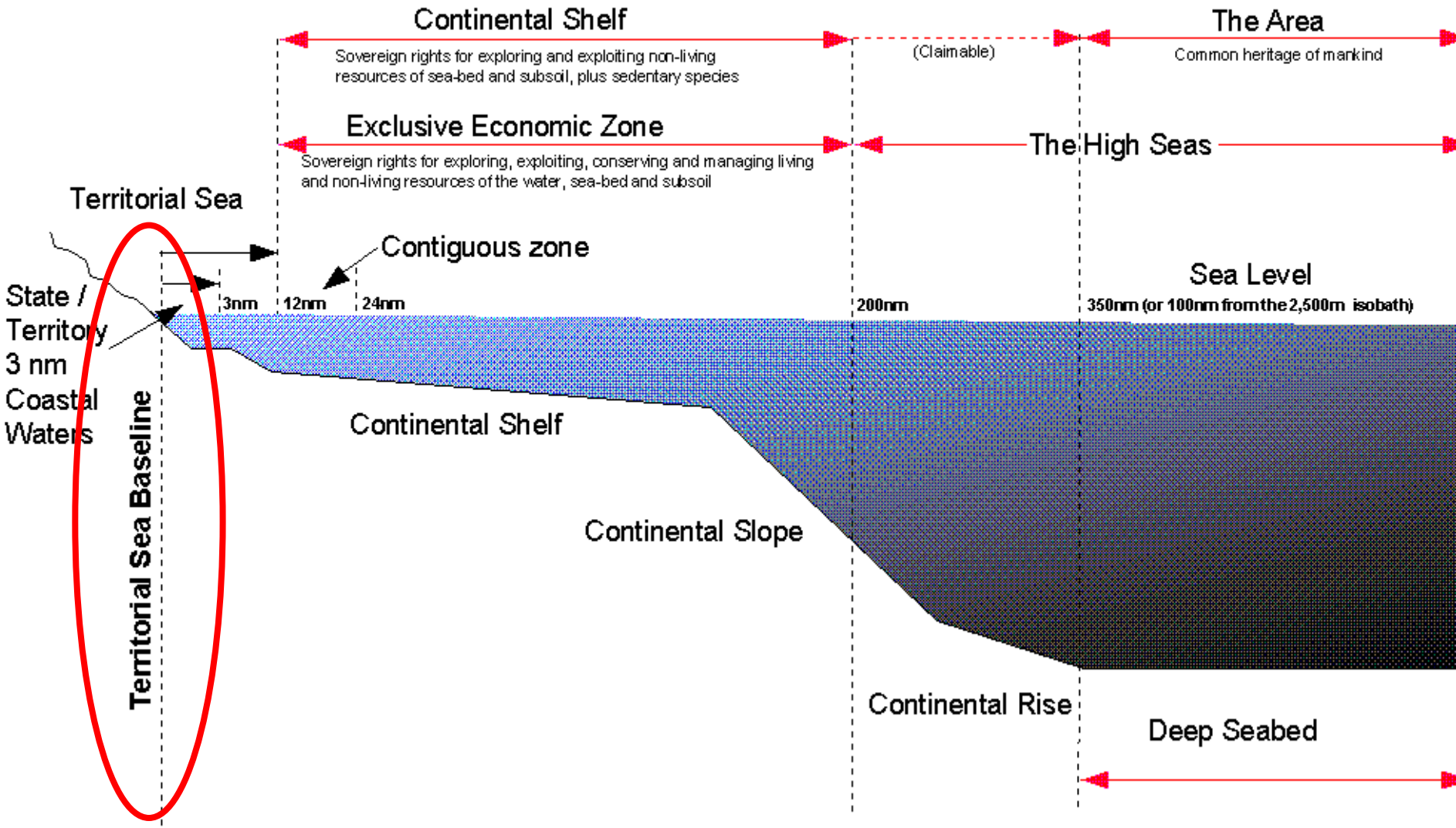
Total population affected: 17 Million (15%)

Total land area affected: 22,000 km^2 (16%)

GRID Arendal UNEP

Source : UNEP/GRID Geneva; University of Dacca; JRO Munich; The World Bank; World Resources Institute, Washington D.C.

MARITIME ZONES



From http://www.environment.gov.au/coasts/oceans-policy/publications/images/maritime-zones.gif

BASELINES

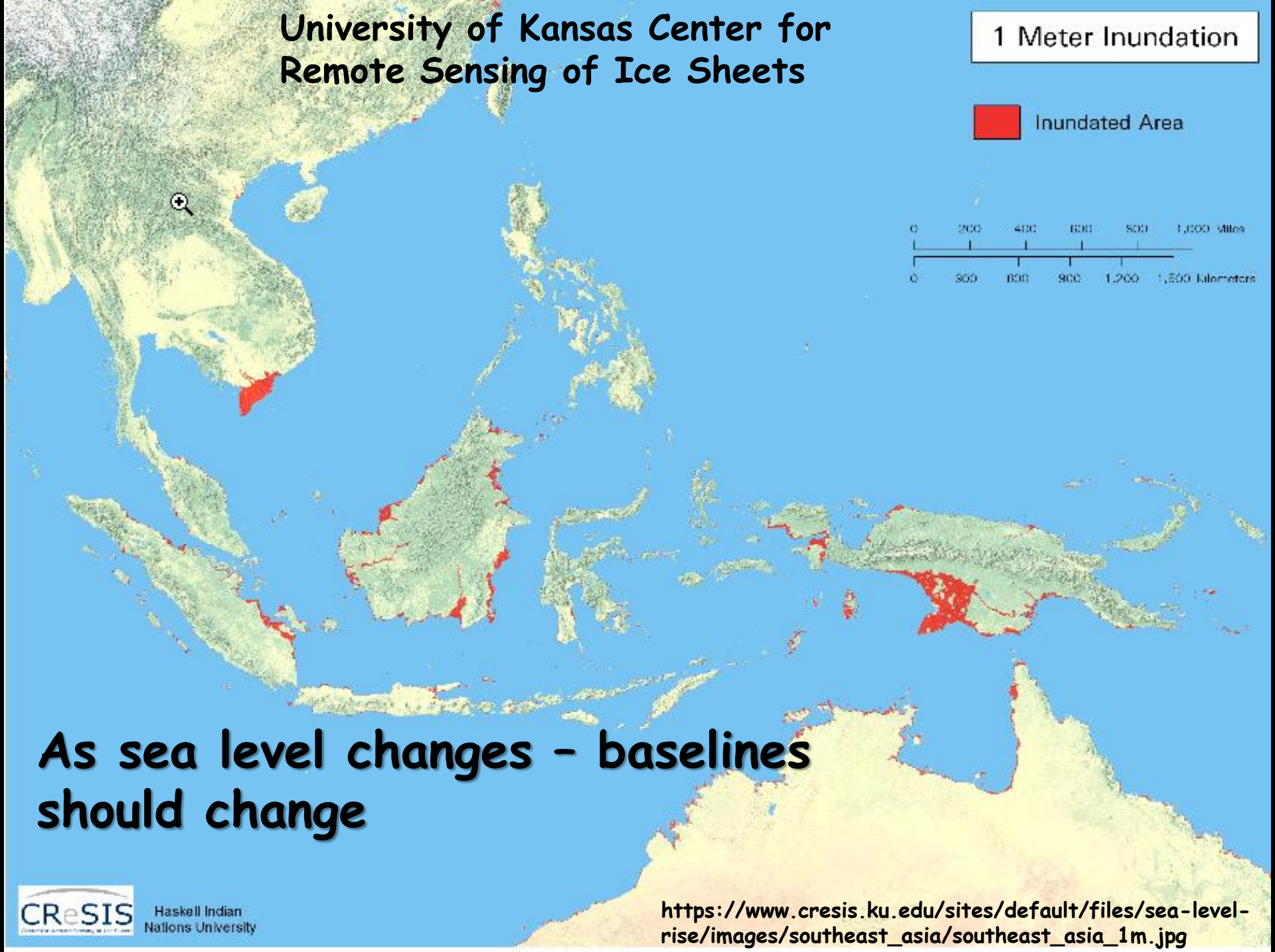
Article 5:

…. "*low water line* along coast as marked on large-scale charts officially recognized by the coastal state."

Article 6:

….islands on atolls, or islands with fringing reefs, *seaward low-water line of reef* as shown by appropriate symbols on charts…"

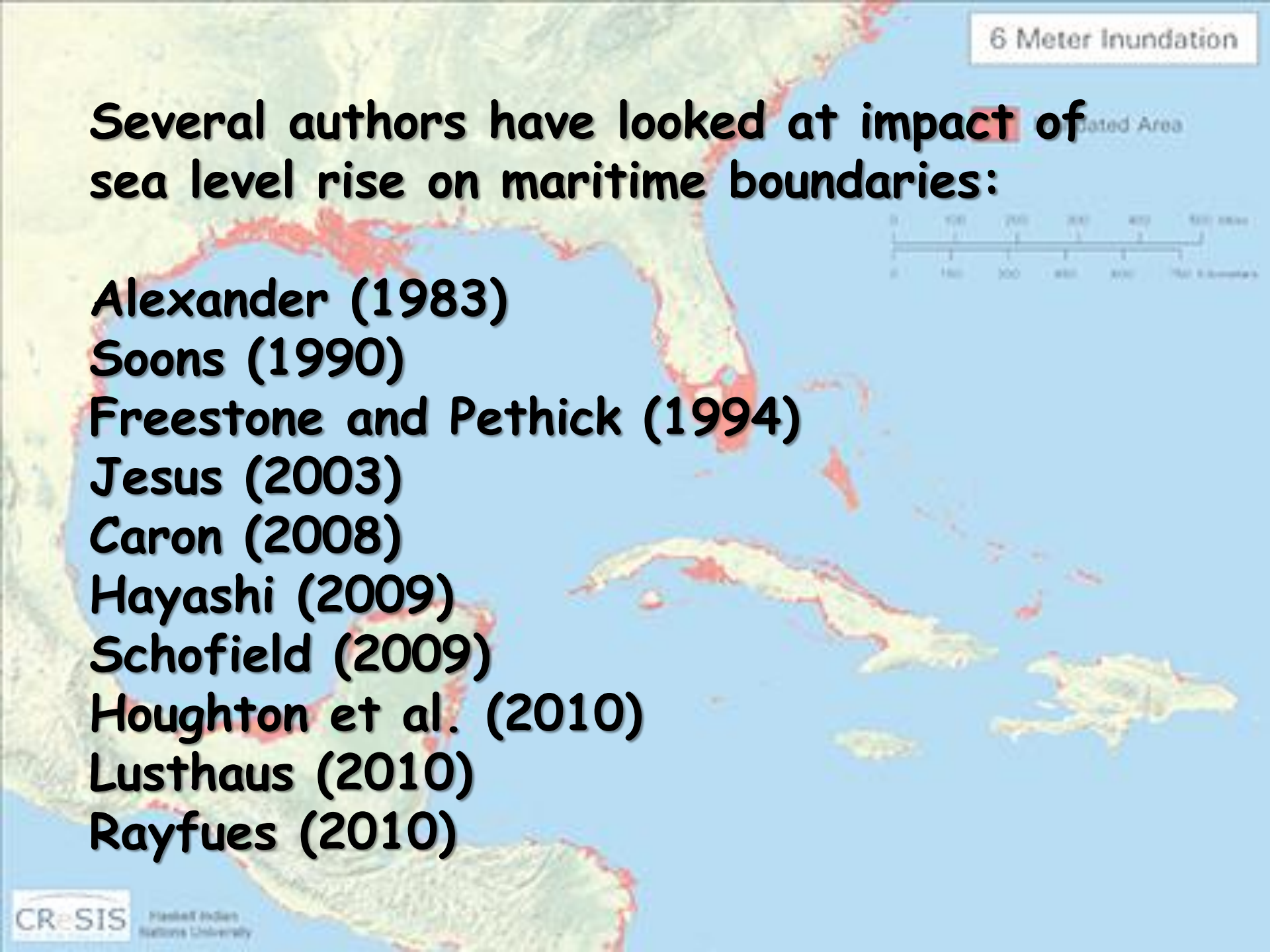
Special case (Straight Baselines) for deeply indented coastlines, fringe of islands and deltas (Article 7).



As sea level changes – baselines should change

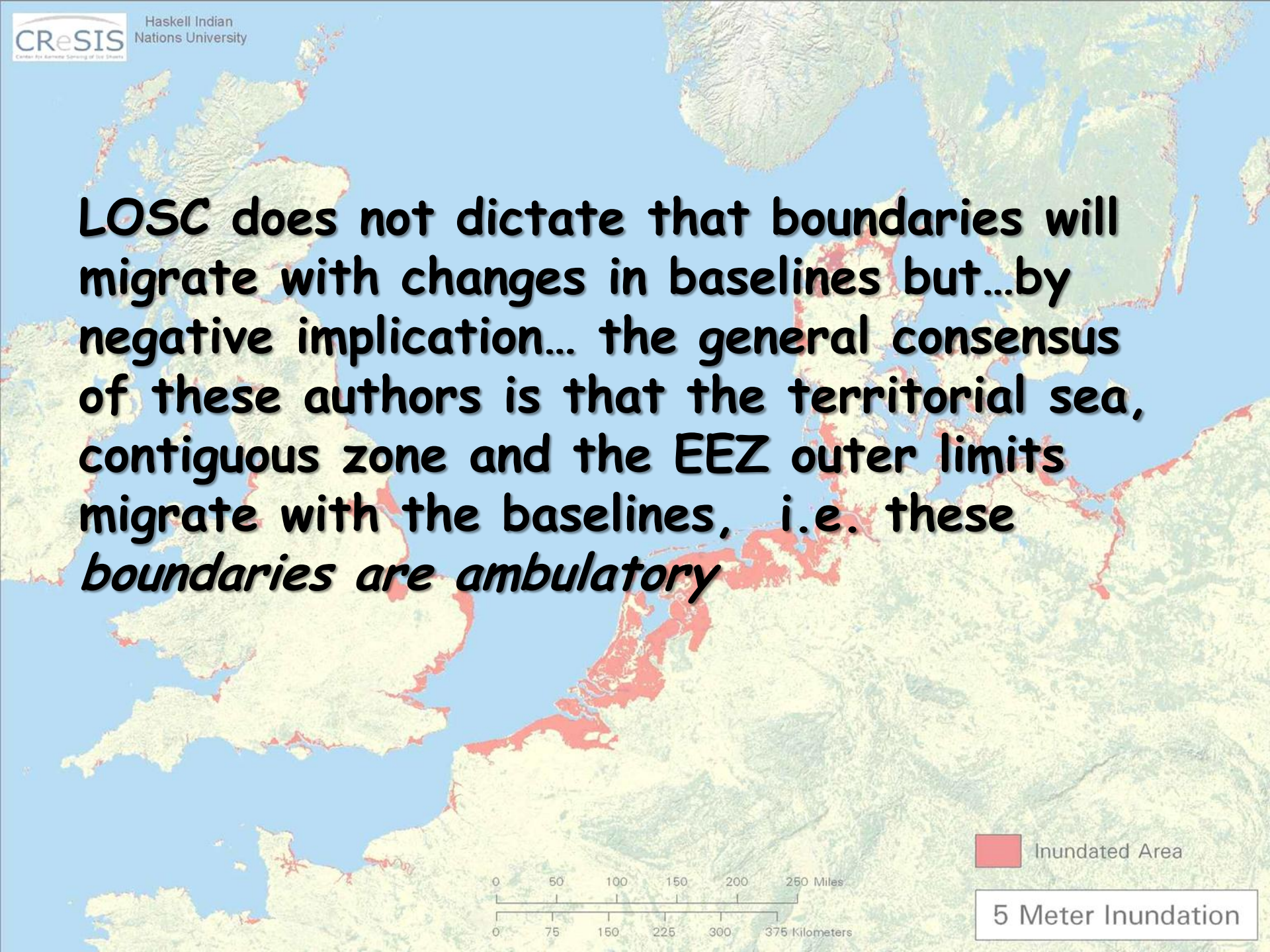
CReSIS Haskell Indian Nations University

https://www.cresis.ku.edu/sites/default/files/sea-level-rise/images/southeast_asia/southeast_asia_1m.jpg



Several authors have looked at impact of sea level rise on maritime boundaries:

Alexander (1983)
Soons (1990)
Freestone and Pethick (1994)
Jesus (2003)
Caron (2008)
Hayashi (2009)
Schofield (2009)
Houghton et al. (2010)
Lusthaus (2010)
Rayfues (2010)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LOSC does not dictate that boundaries will migrate with changes in baselines but…by negative implication… the general consensus of these authors is that the territorial sea, contiguous zone and the EEZ outer limits migrate with the baselines, i.e. these boundaries are ambulatory
0 50 100 150 200 250 Miles
0 75 150 225 300 375 Kilometers
Inundated Area
5 Meter Inundation

Negative implication comes from:

Article 7(2):

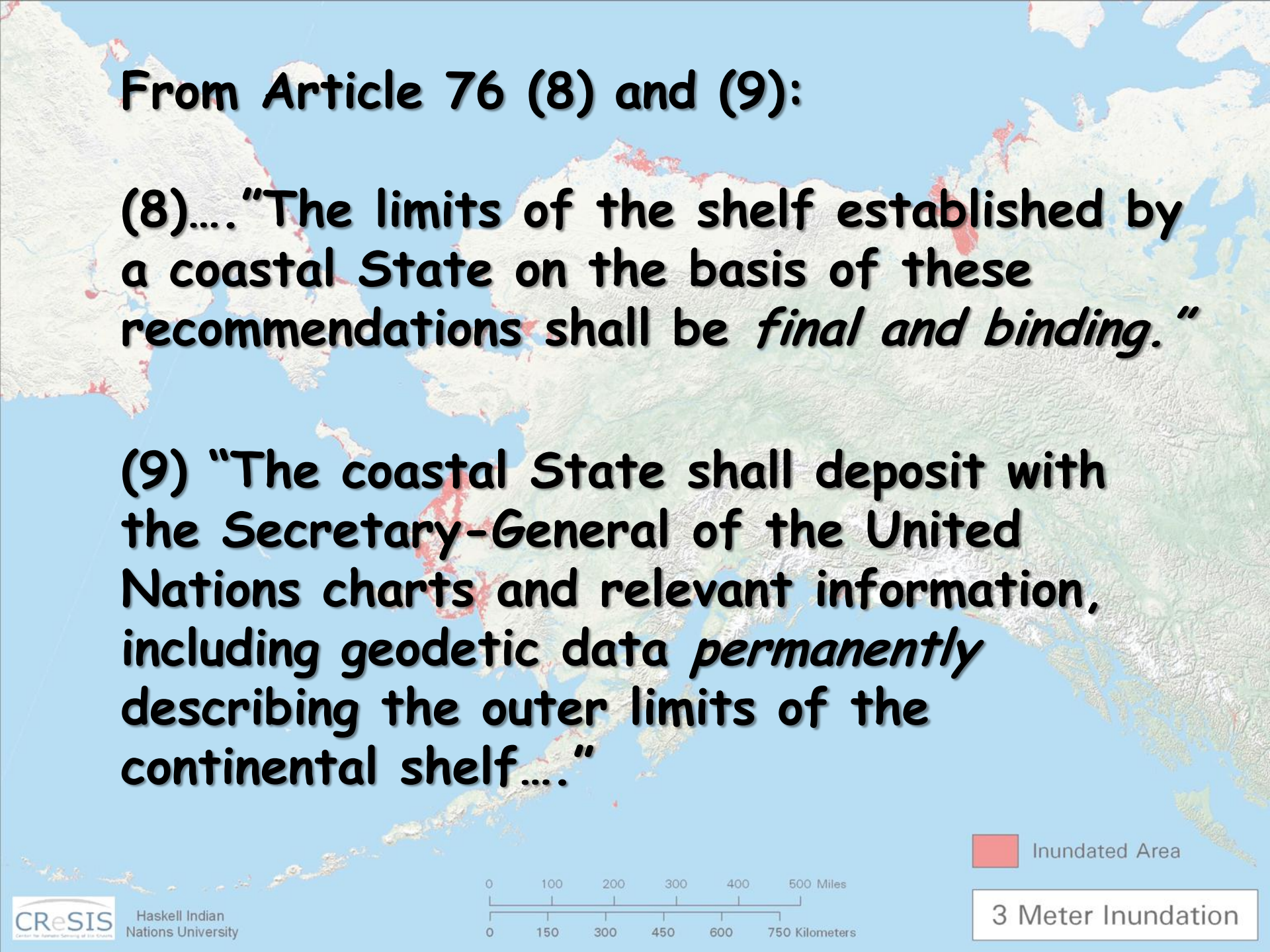
" where because of the presence of a delta and other natural conditions the coastline is highly unstable, the appropriate points may be selected along the furthest seaward extent of the low-water line, and *not withstanding subsequent regression of the low-water line, the straight-line baselines shall remain effective until changed by the coastal state in accordance with the Convention"*

and

From Article 76 (8) and (9):

(8)…."The limits of the shelf established by a coastal State on the basis of these recommendations shall be *final and binding.*"

(9) "The coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data *permanently* describing the outer limits of the continental shelf…."



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CReSIS

Center for Remote Sensing of Ice Sheets

Commentators have focused on effect of sea-level rise on territorial sea, contiguous zone and EEZ – and particularly the legal implications of this situation for island and low-lying coastal states – the extreme case being "disappearing" states – e.g. Kiribati, Marshall Islands, Tuvalu, etc.

Alexander (1983)
Soons (1990)
Freestone and Pethick (1994)
Jesus (2003)
Caron (2008)
Hayashi (2009)
Schofield (2009)
Houghton et al. (2010)
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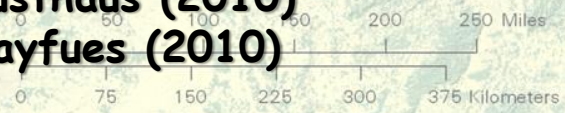


Inundated Area

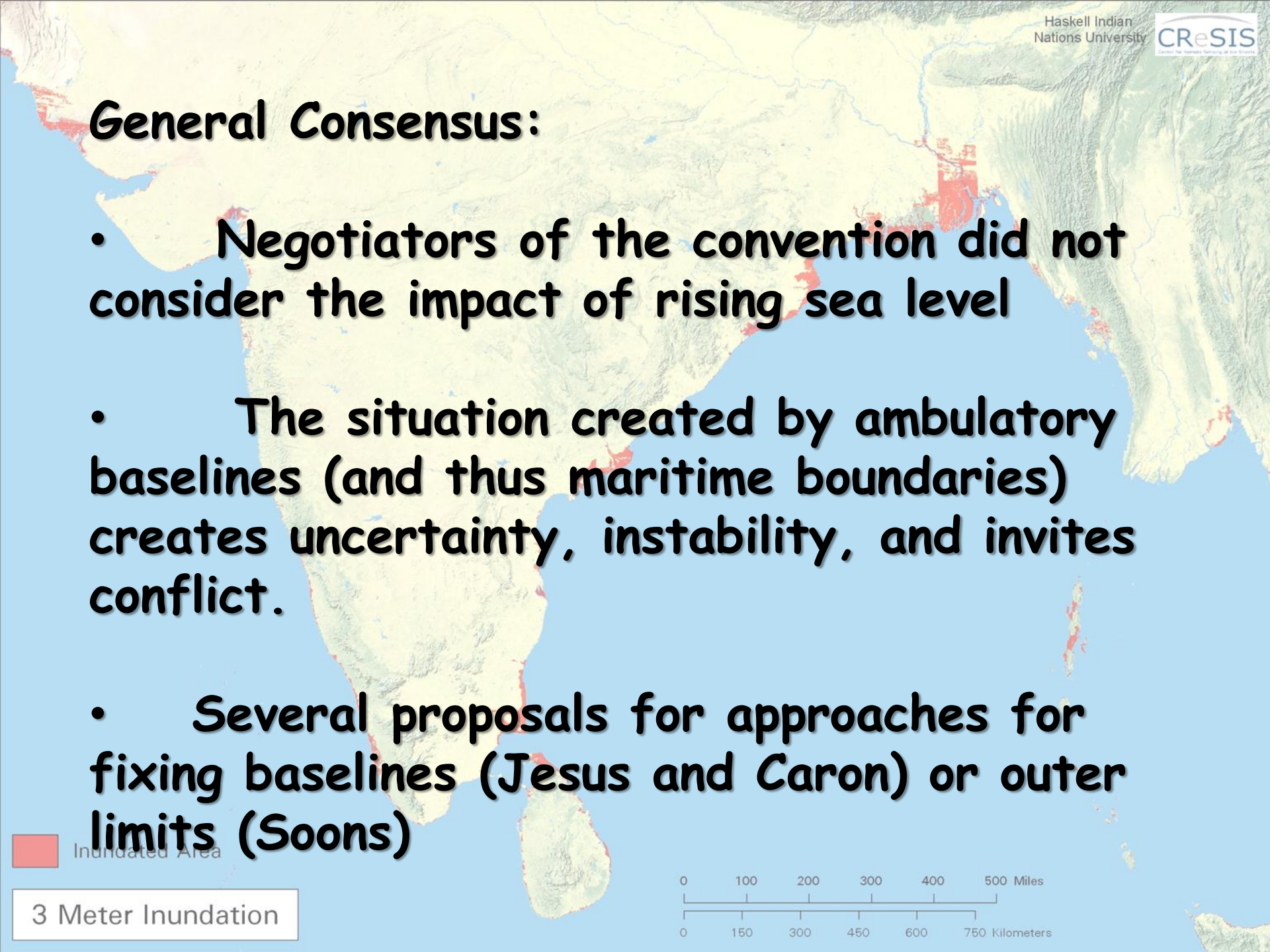
3 Meter Inundation

General Consensus:

- Negotiators of the convention did not consider the impact of rising sea level

- The situation created by ambulatory baselines (and thus maritime boundaries) creates uncertainty, instability, and invites conflict.

- Several proposals for approaches for fixing baselines (Jesus and Caron) or outer limits (Soons)



Professor Hayashi has offered a detailed look at legal and policy options for this and proposed a new rule:

"A coastal state may declare the baselines established in accordance with the relevant provisions of UNCLOS as permanent once it has shown them on charts of an adequate scale or described them by a list of geographical coordinates and given due publicity thereto, notwithstanding subsequent changes in geographic features of coasts or islands due to sea level rise"

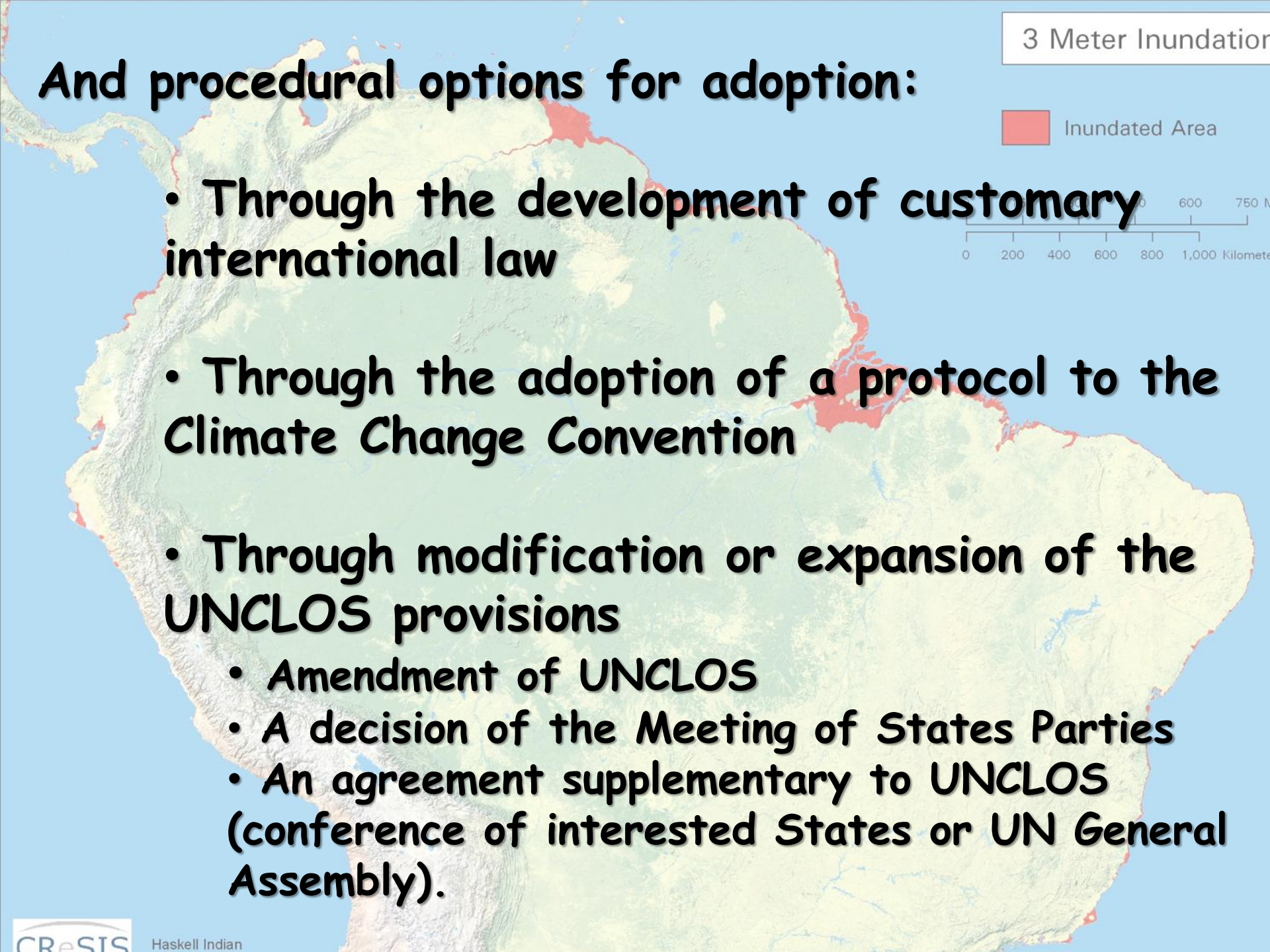
Hayashi, M, 2009, Sea level rise and the Law of the Sea: Legal and Policy Options, Intl. Symposium on Islands and Oceans, Tokyo, p. 78-90

Inundated Area

3 Meter Inundation

0 100 200 300 400 500 Miles

0 150 300 450 600 750 Kilometers



And procedural options for adoption:

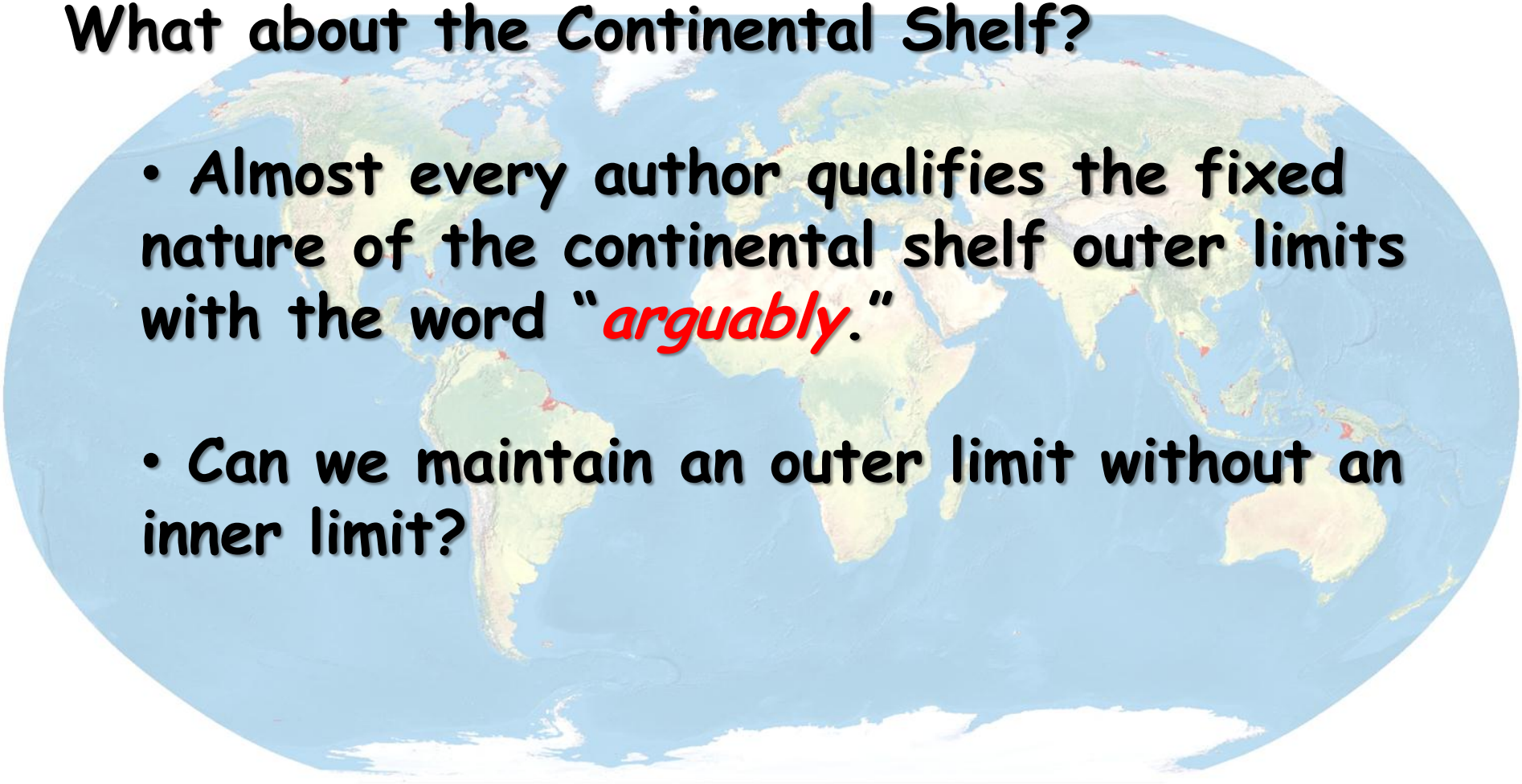
- Through the development of customary international law

- Through the adoption of a protocol to the Climate Change Convention

- Through modification or expansion of the UNCLOS provisions
  - Amendment of UNCLOS
  - A decision of the Meeting of States Parties
  - An agreement supplementary to UNCLOS (conference of interested States or UN General Assembly).

3 Meter Inundation

What about the Continental Shelf?



- Almost every author qualifies the fixed nature of the continental shelf outer limits with the word "*arguably*."

- Can we maintain an outer limit without an inner limit?

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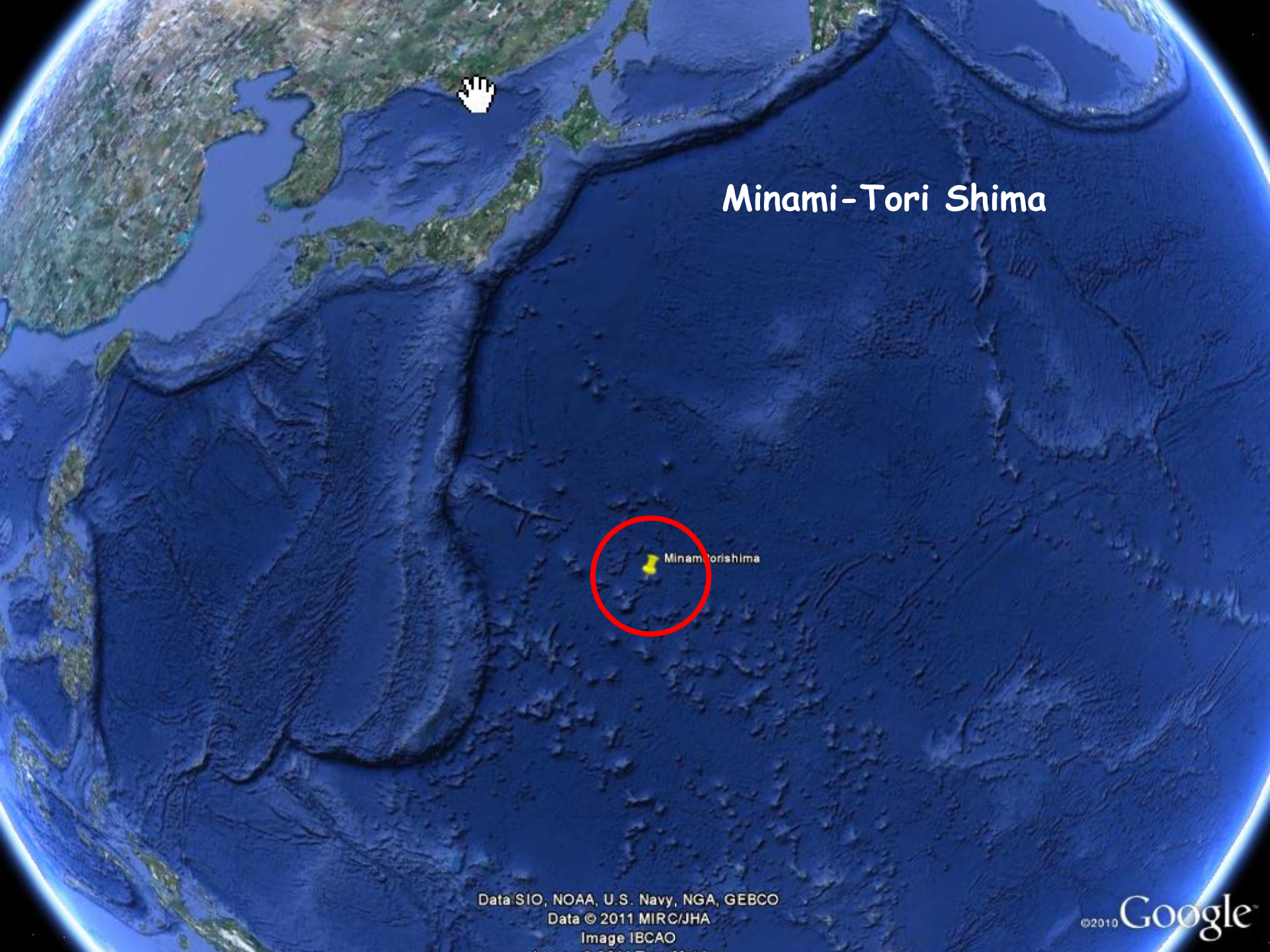
Inundated Area

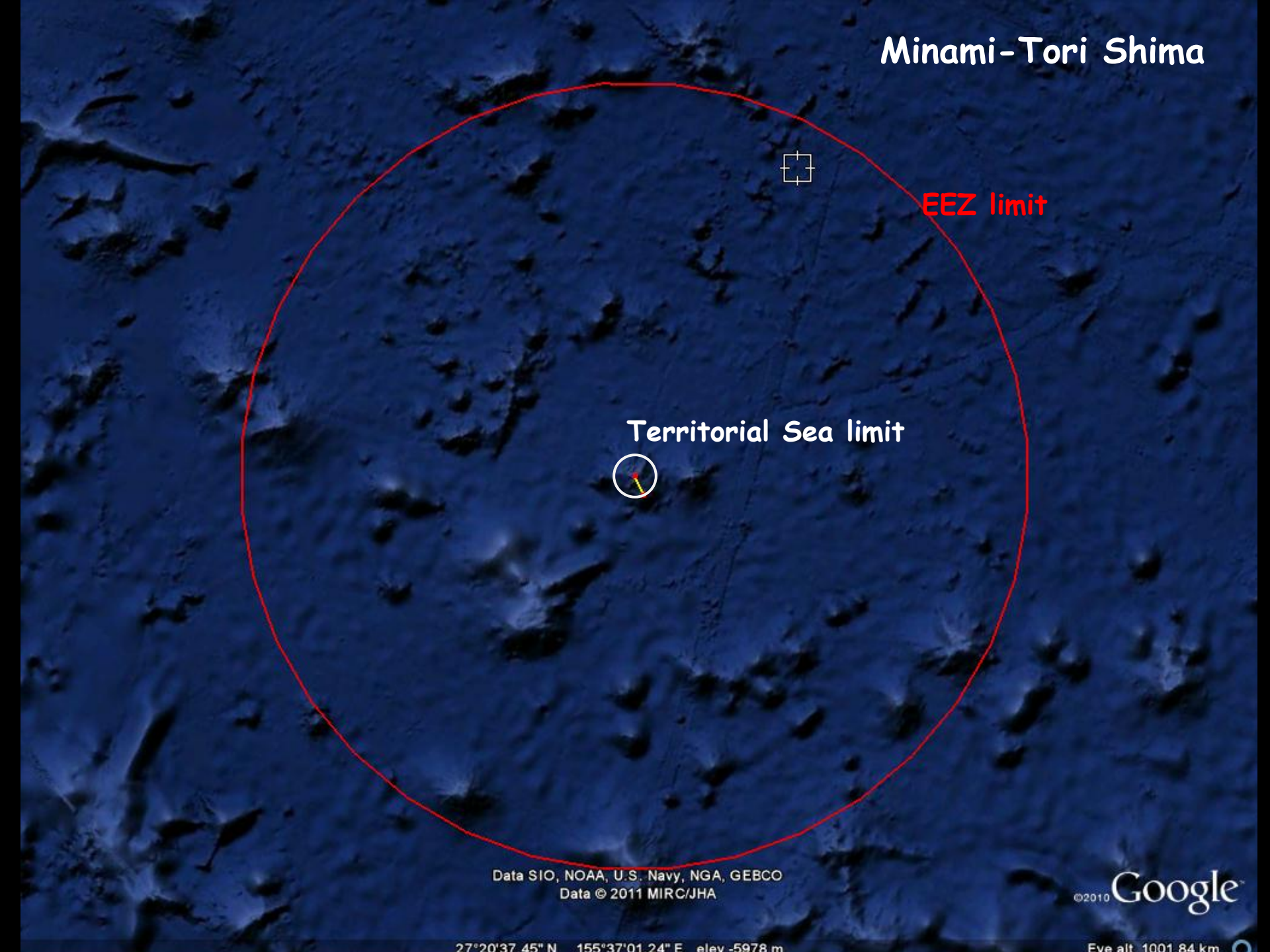
0 1,500 3,000 4,500 6,000 7,500 Miles

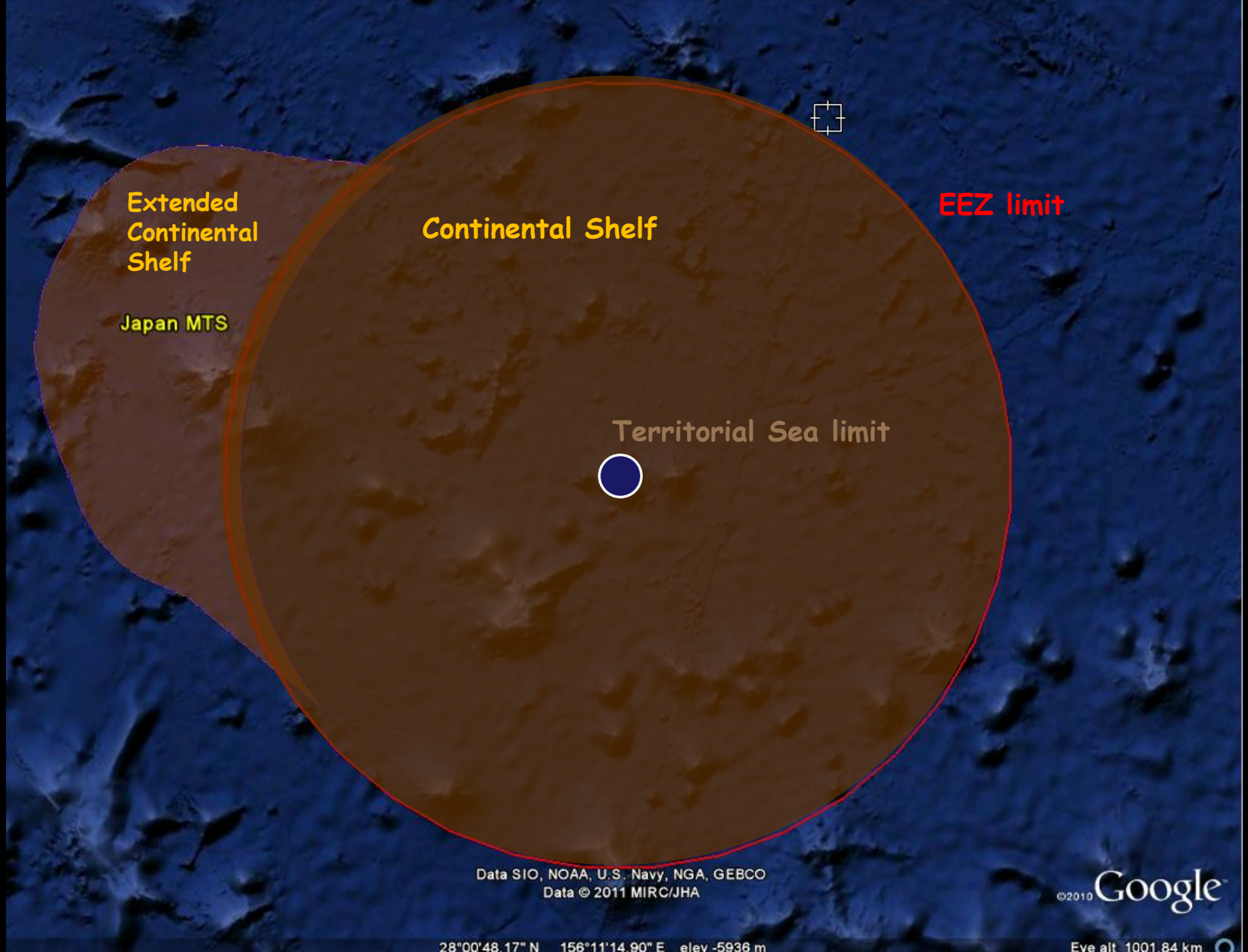
0 2,000 4,000 6,000 8,000 10,000 Kilometers


Minami-Tori Shima
Minamitorishima
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data © 2011 MIRC/JHA
Image IBCAO
©2010 Google

Minami-Tori Shima

- Coral Atoll – easternmost territory of Japan
- Total Land Area – 0.5 sq. mi
- Elevation typically 5 m (9 m max)


Minami-Tori Shima
EEZ limit
Territorial Sea limit
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data © 2011 MIRC/JHA
©2010 Google
27°20'37.45" N 155°37'01.24" E elev -5978 m
Eye alt 1001.84 km


Extended Continental Shelf
Japan MTS
Continental Shelf
EEZ limit
Territorial Sea limit
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data © 2011 MIRC/JHA
©2010 Google
28°00'48.17" N 156°11'14.90" E elev -5936 m
Eye alt 1001.84 km

Extended Continental Shelf
Japan MTS
Continental Shelf
Territorial Sea limit
Island to Rock
No EEZ
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data © 2011 MIRC/JHA
©2010 Google
28°00'48.17" N 156°11'14.90" E elev -5936 m
Eye alt 1001.84 km

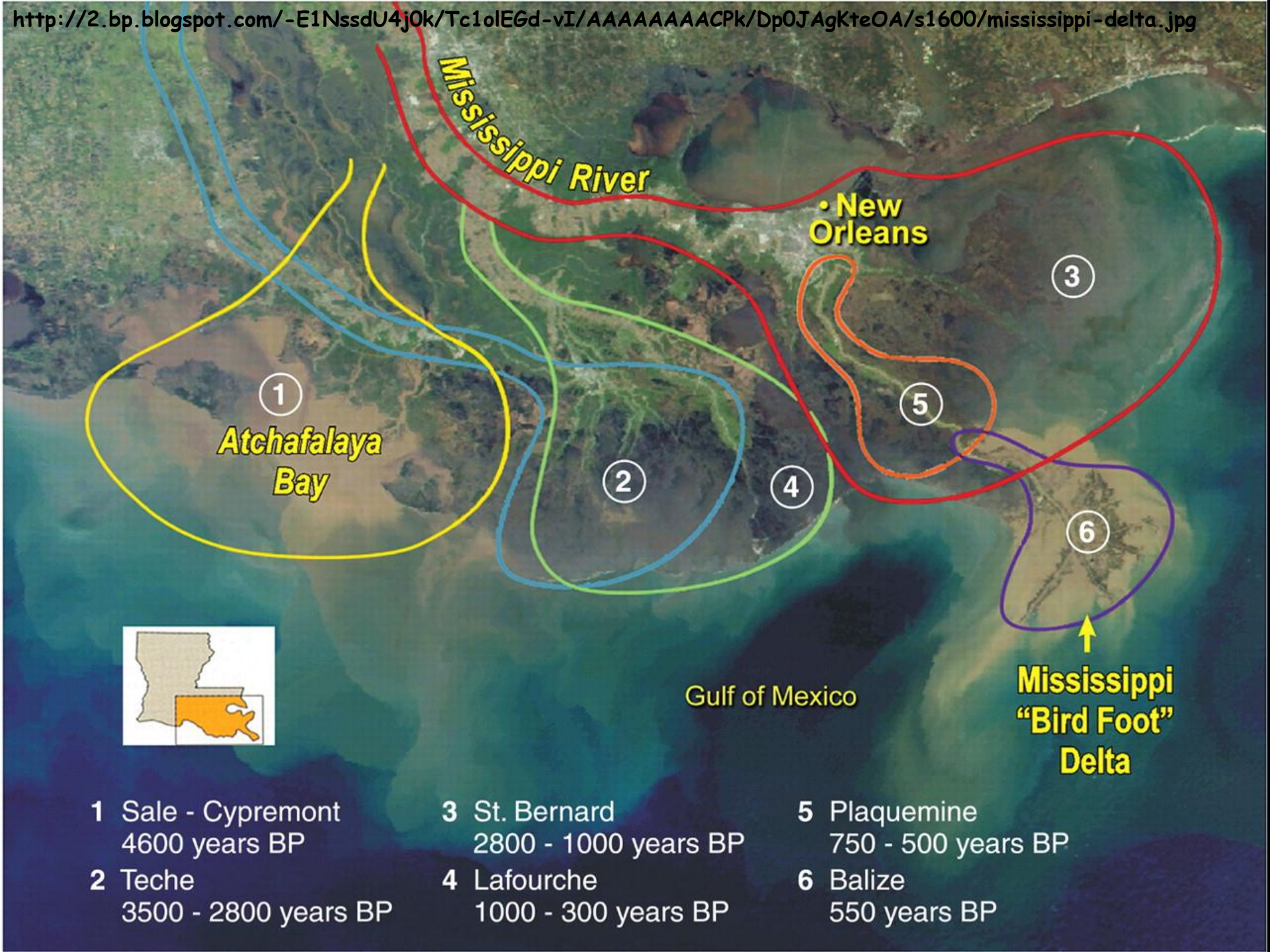
Extended Continental Shelf
Continental Shelf
Japan MTS
Disappearance of Rock
Can we have an outer limit without an inner limit or starting point?
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data © 2011 MIRC/JHA
©2010 Google
28°00'48.17" N 156°11'14.90" E elev -5936 m
Eye alt 1001.84 km

Haskell Indian Nations University

Is there an easier way to fixing baselines? (at least temporarily)

Article 7(2): " where because of the presence of a delta and other natural conditions the coastline is highly unstable, the appropriate points may be selected along the furthest seaward extent of the low-water line, and *not withstanding subsequent regression of the low-water line, the straight-line baselines shall remain effective until changed by the coastal state in accordance with the Convention"*

http://2.bp.blogspot.com/-E1NssdU4j0k/Tc1olEGd-vI/AAAAAAAACPk/Dp0JAgKteOA/s1600/mississippi-delta.jpg



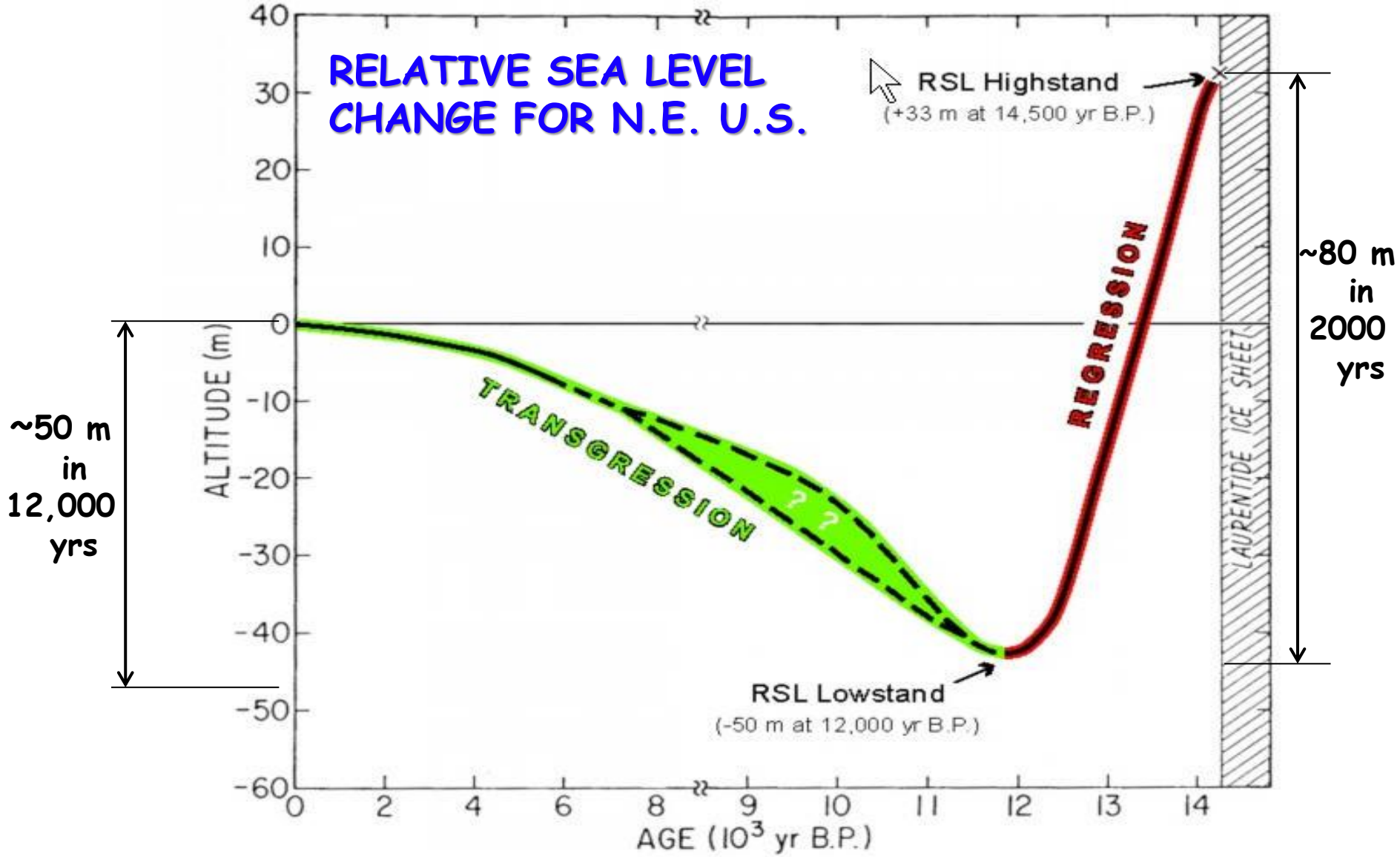
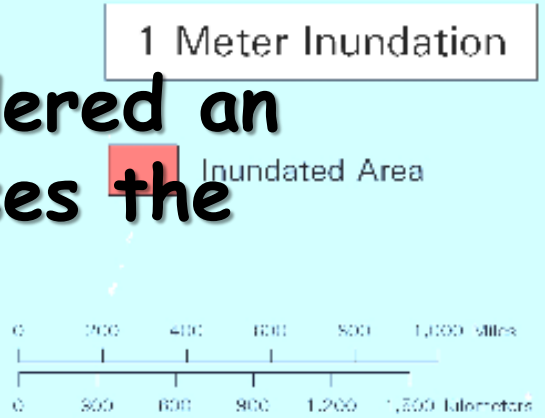


Figure 4.1. Late Quaternary relative sea-level curve for northeastern Massachusetts (modified from Oldale and others, 1993). Over the last 14,500 years, relative sea level fell from a highstand of about +33 m to a lowstand of about -50 m, and then rose at varying rates to the present. These large fluctuations in relative sea level drove regression (red shading) and transgression (green shading) of the shoreline across the inner continental shelf. The dashed lines indicate uncertainty in the sea-level data. Note that the age scale changes at 8,000 years B.P.

Raised Beaches – New Zealand



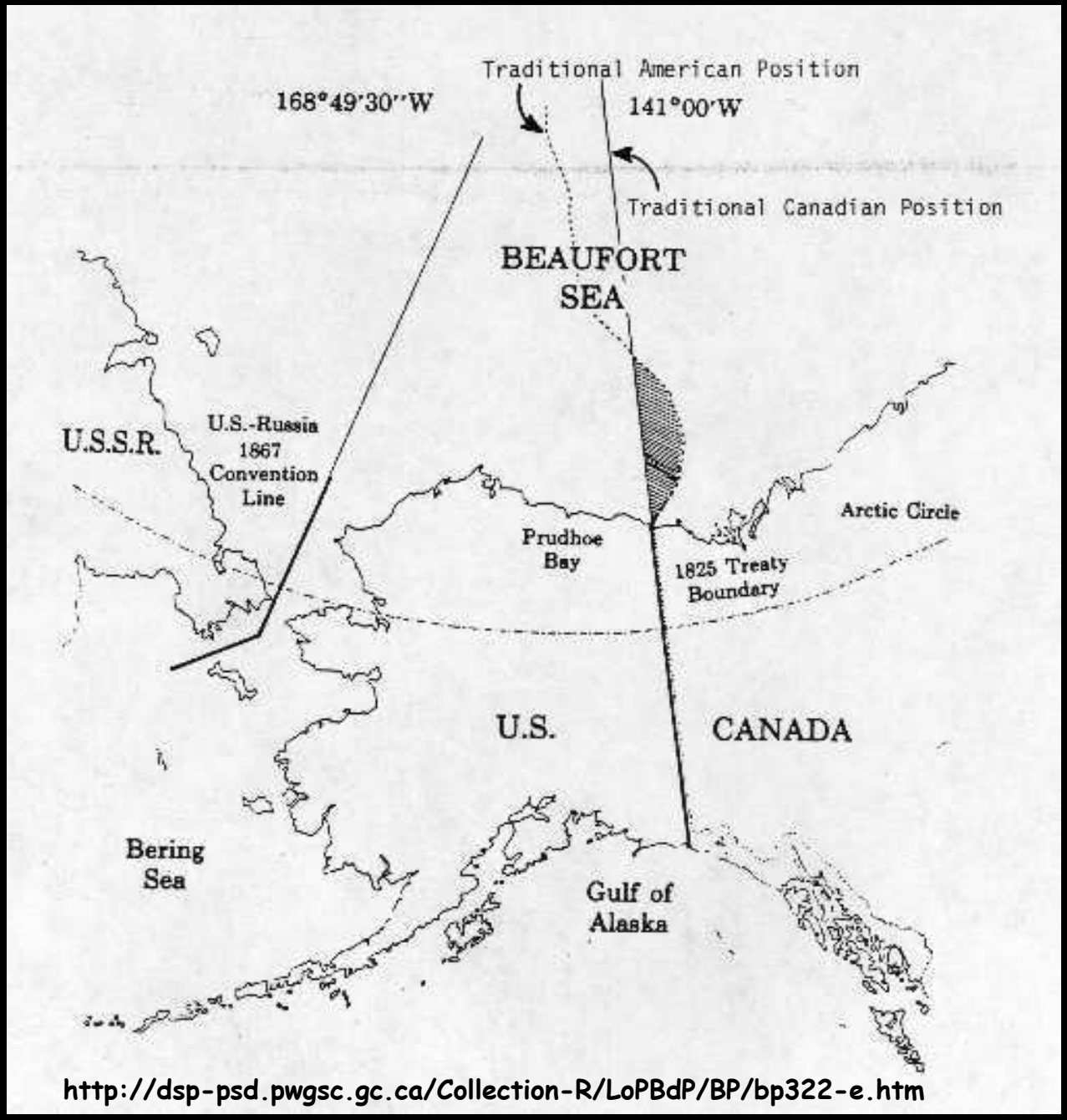
Why is sea level change not considered an "*other natural condition*" that causes the coastline to be highly unstable?

If so this would provide mechanism to fix baselines -- but only temporarily – until changed by coastal state

A final point:

Any proposal that would fix baselines – will need to decouple baselines used for maritime boundaries from those of nautical chart (Articles 5 and 6) – nautical charts MUST be updated for safety of navigation purposes.

GREENPEACE



http://dsp-psd.pwgsc.gc.ca/Collection-R/LoPBdP/BP/bp322-e.htm