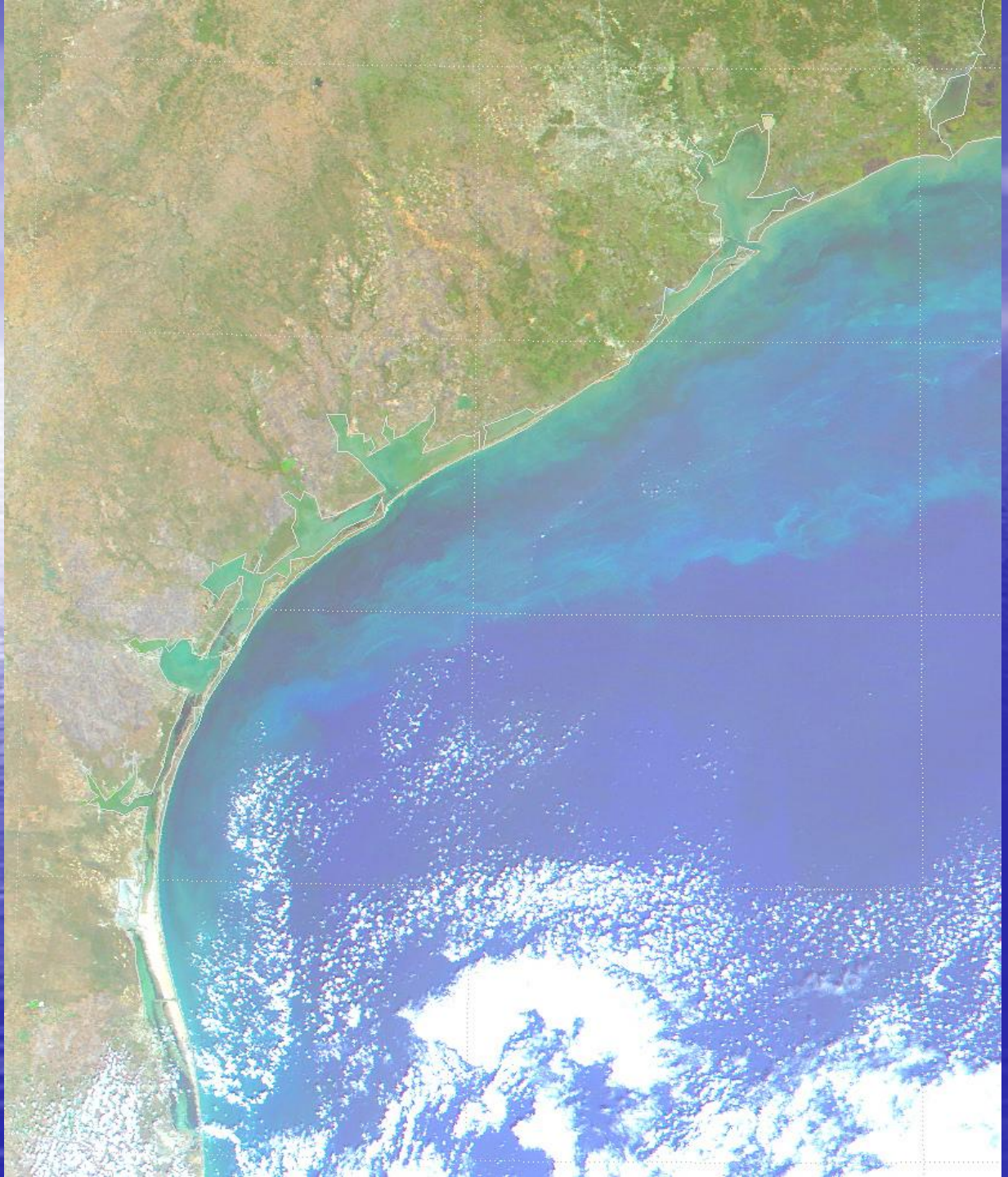

Texas passes, longshore transport, hurricanes, beach erosion and sea level

Richard L. Watson, Ph.D.

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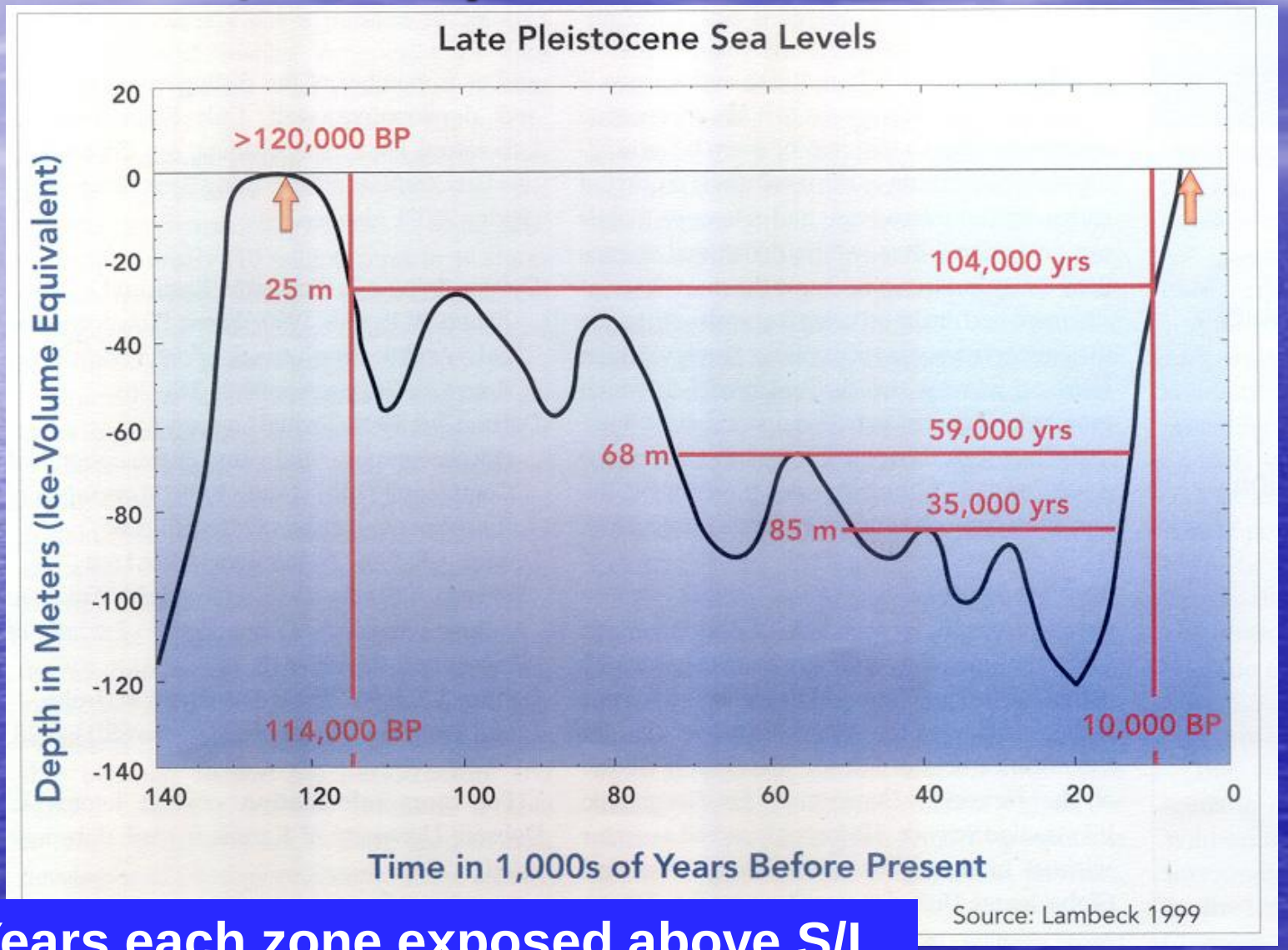
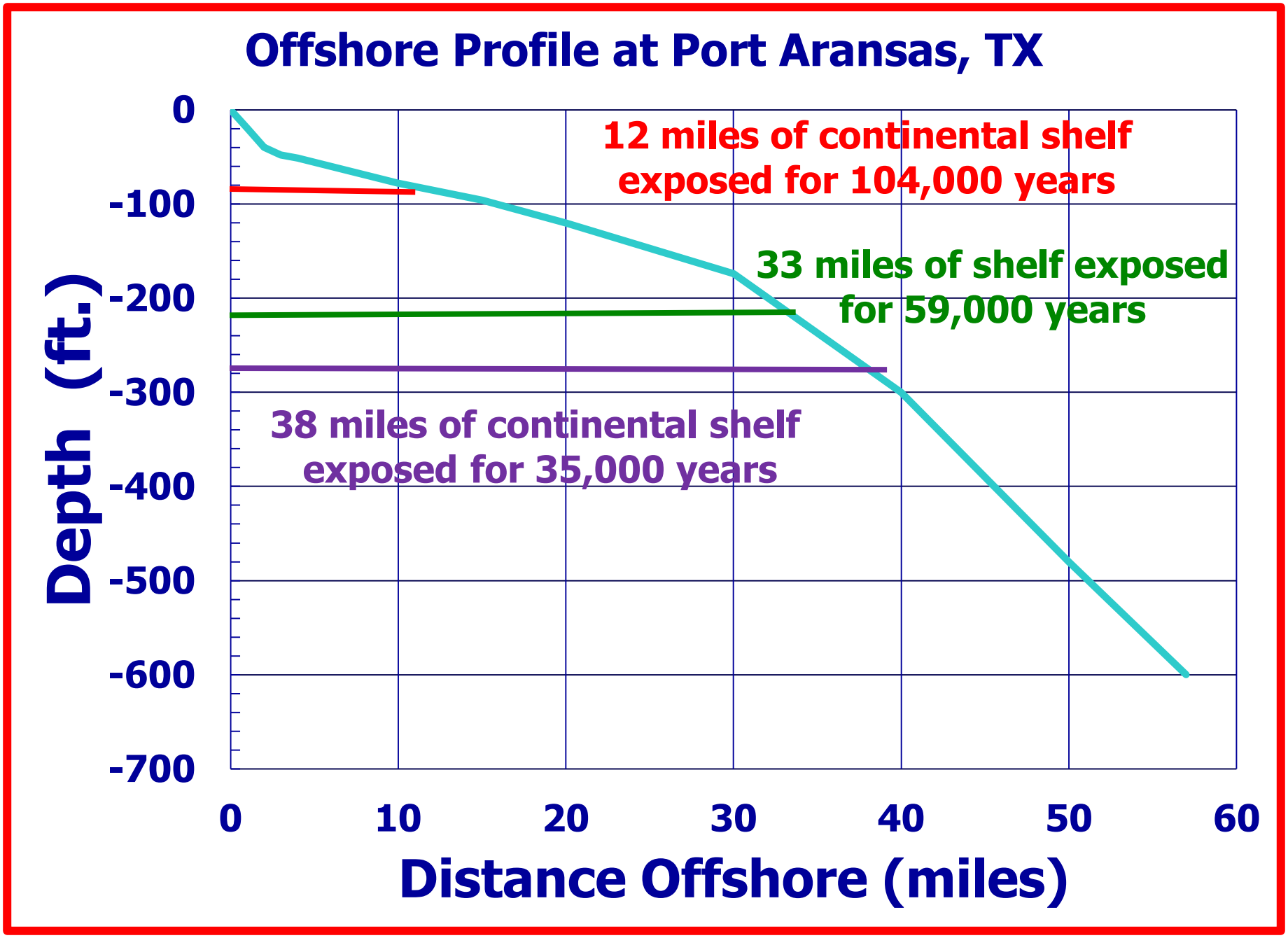
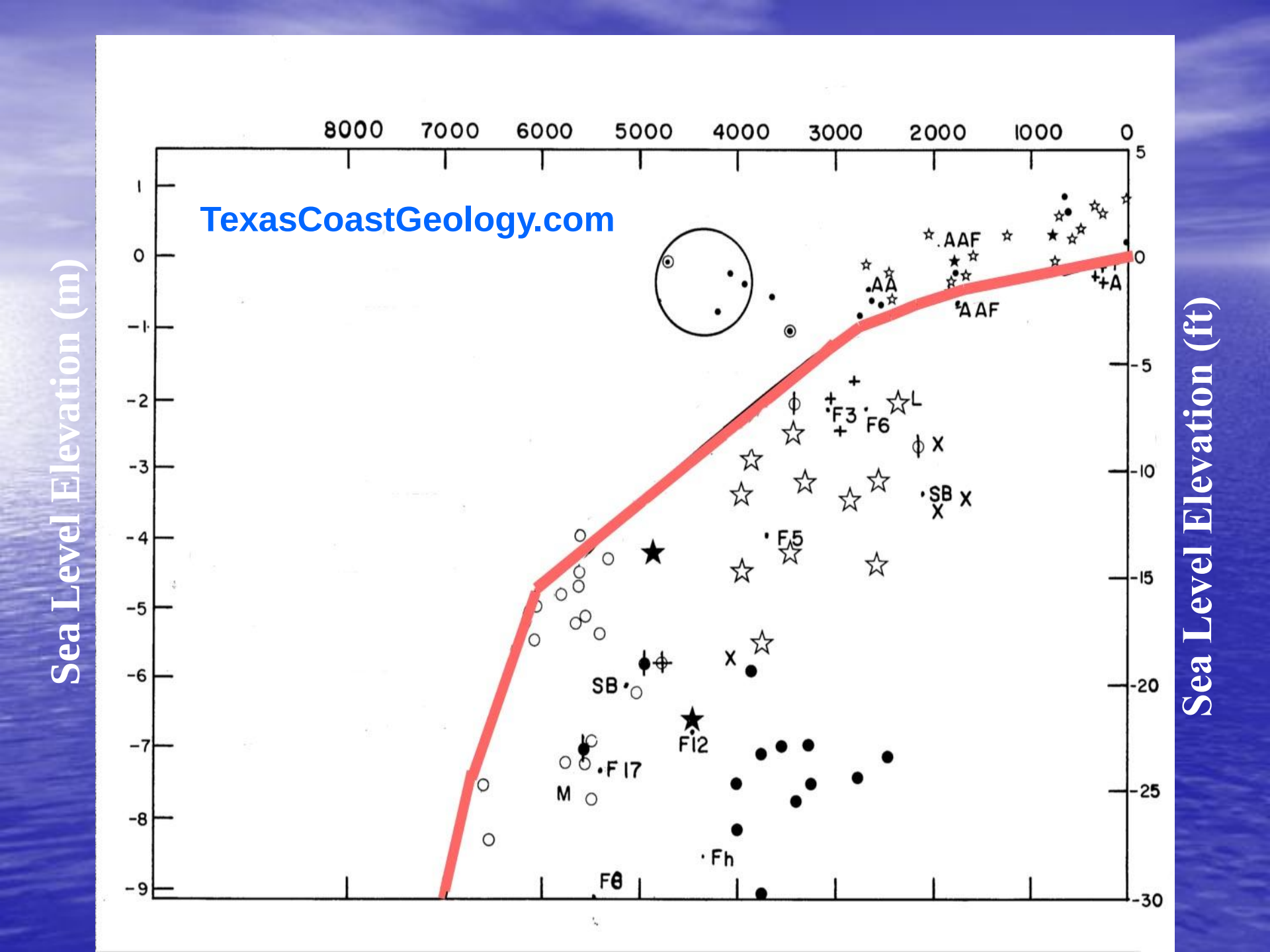
Field work can be strange!

120,000 years of sea level

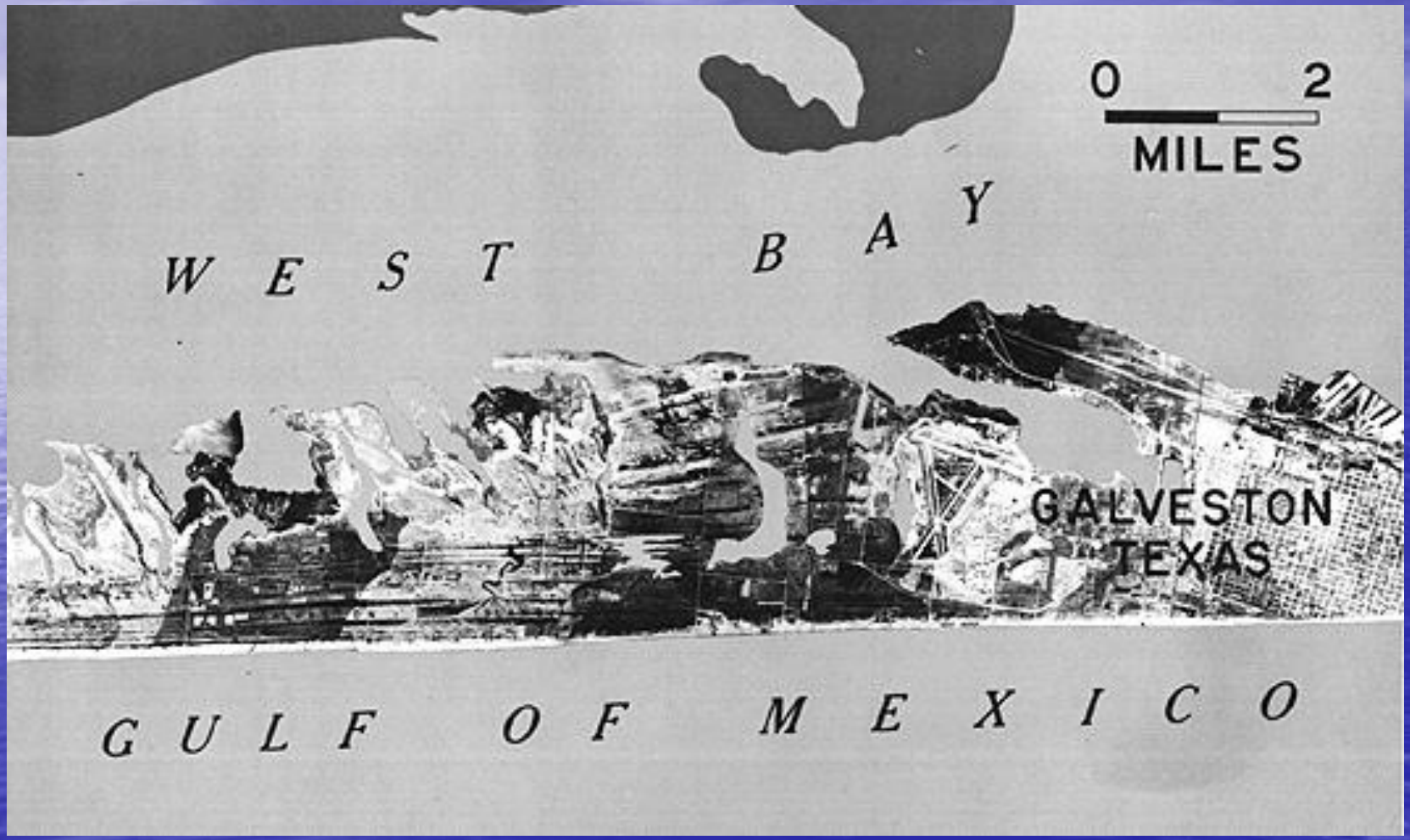


Years each zone exposed above S/L


Offshore Profile at Port Aransas, TX
0
-100
-200
-300
-400
-500
-600
-700
Depth (ft.)
12 miles of continental shelf
exposed for 104,000 years
33 miles of shelf exposed
for 59,000 years
38 miles of continental shelf
exposed for 35,000 years
0
10
20
30
40
50
60
Distance Offshore (miles)


Sea Level Elevation (m)
Sea Level Elevation (ft)
TexasCoastGeology.com
8000
7000
6000
5000
4000
3000
2000
1000
0
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
5
0
-5
-10
-15
-20
-25
-30
AAF
AA
AAF
+A
F3
F6
L
X
SB
X
X
F5
X
SB
F12
F 17
M
Fh
Fθ

Beach Ridges, Galveston Island



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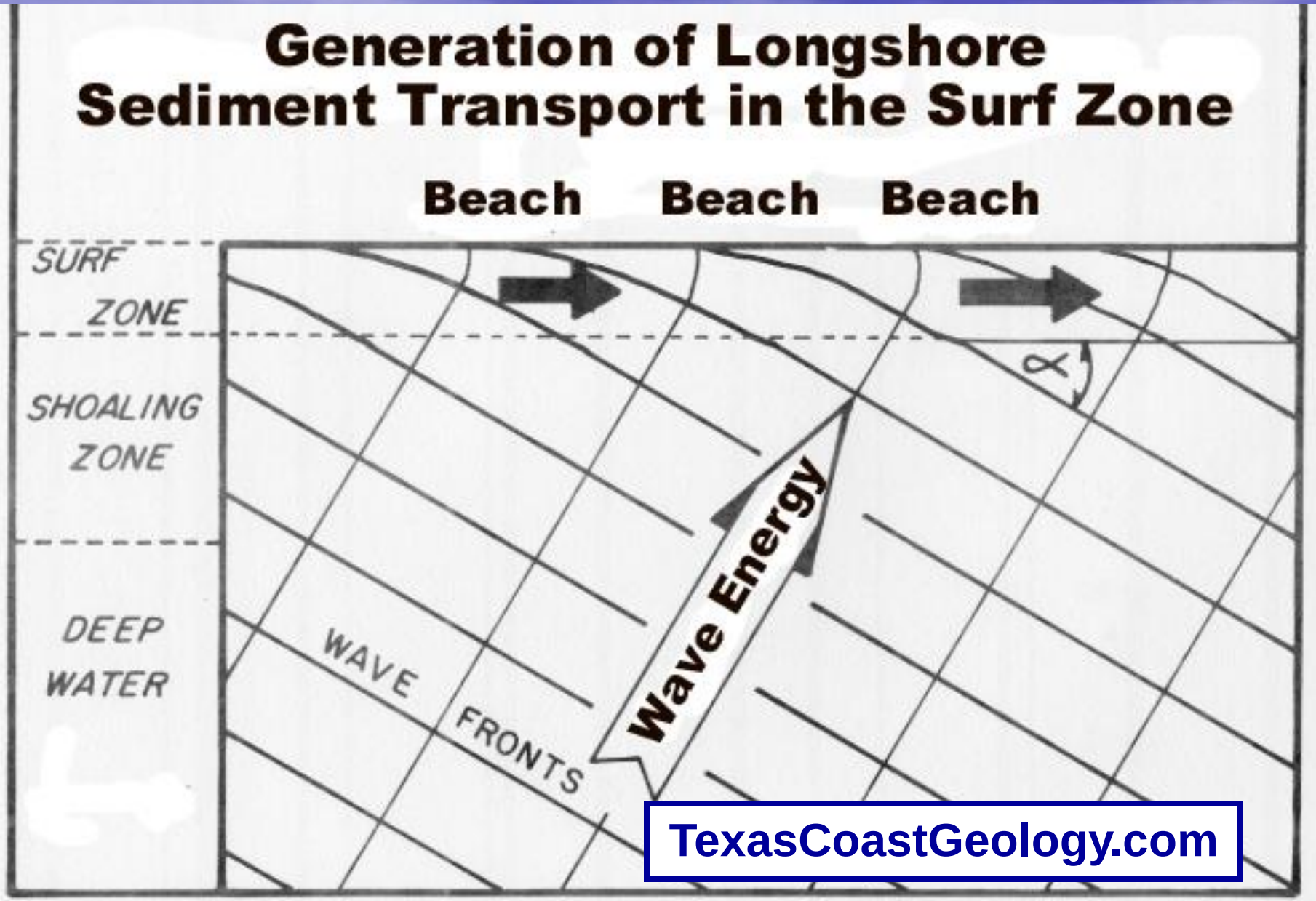
Generation of Longshore Sediment Transport in the Surf Zone



A River of Sand,
Sand Movement in the Surf Zone

- *700,000 to 800,000 cuyd/yr*
- *250 Dump Trucks Per Day*
- *One Dump Truck Every 6 Minutes*

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New Colorado River Delta

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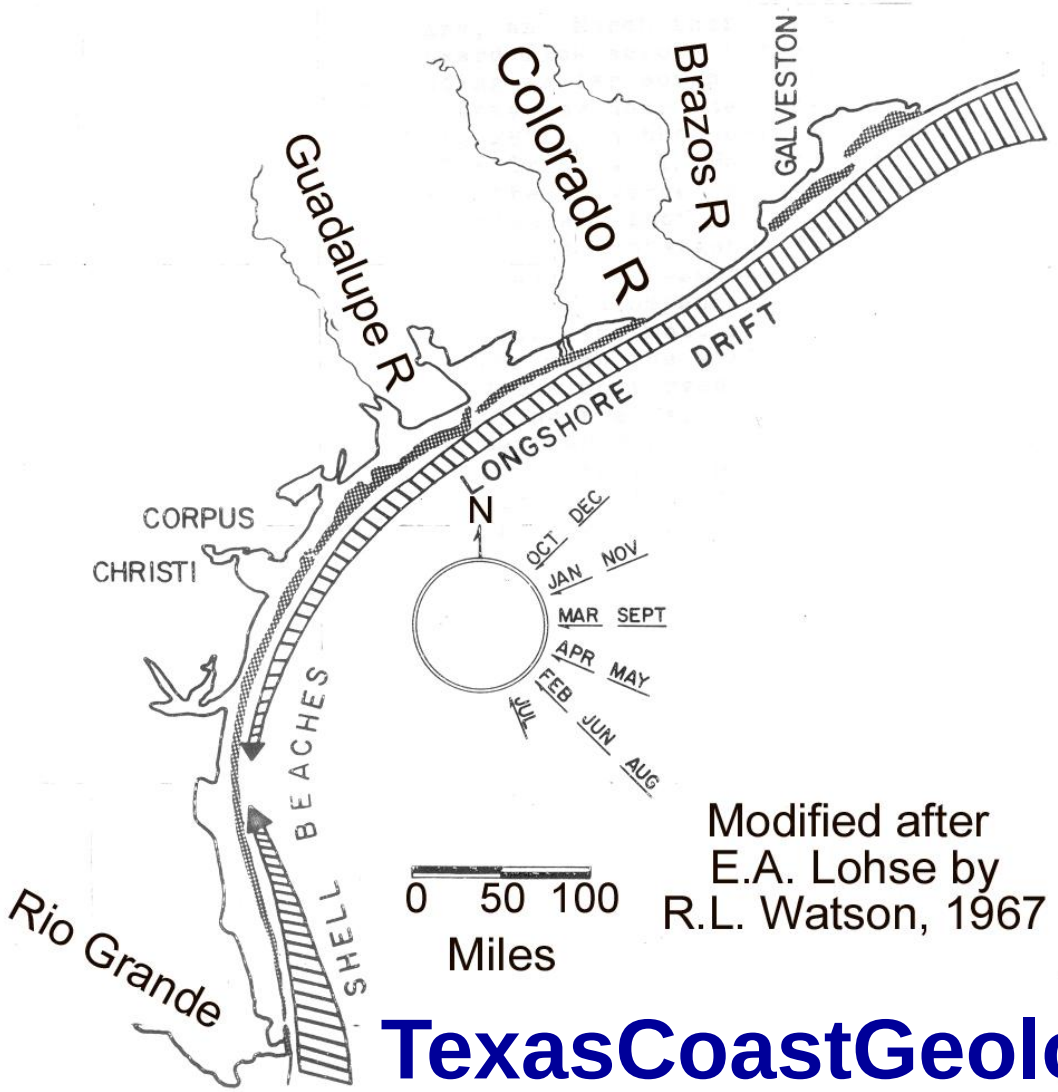
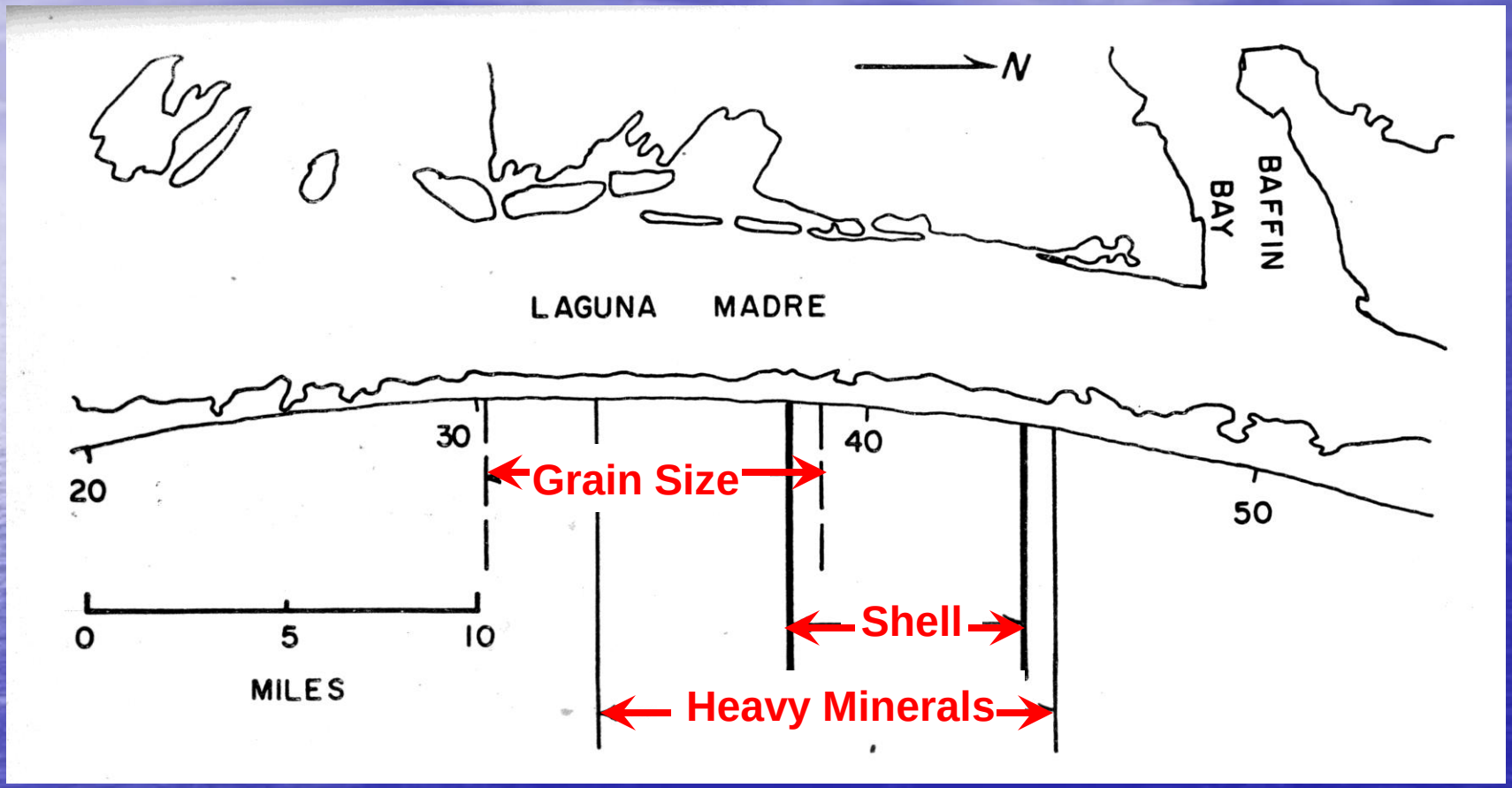
Convergence of Longshore Sediment Transport



Modified after
E.A. Lohse by
R.L. Watson, 1967

Central Padre Transition Zones



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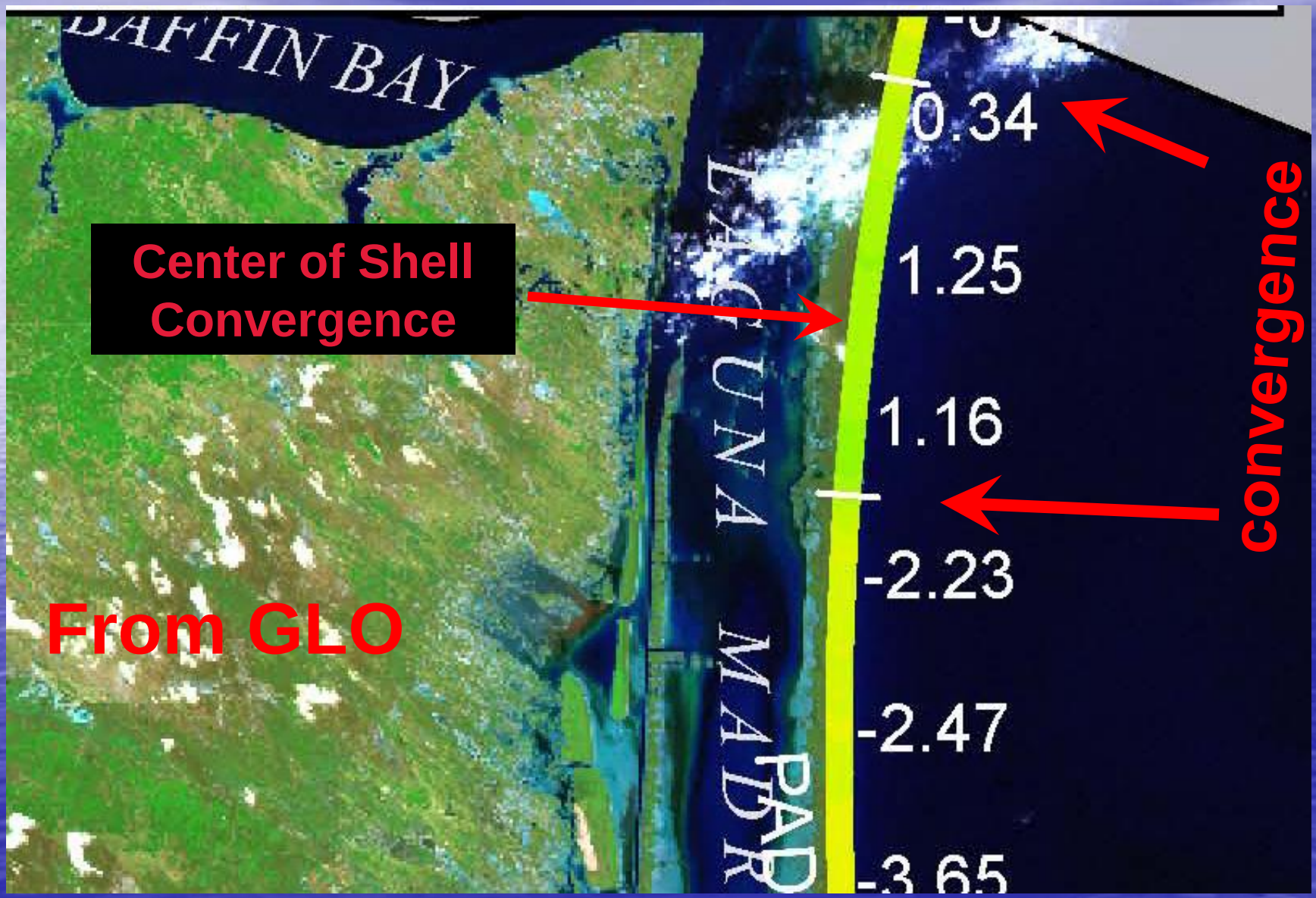
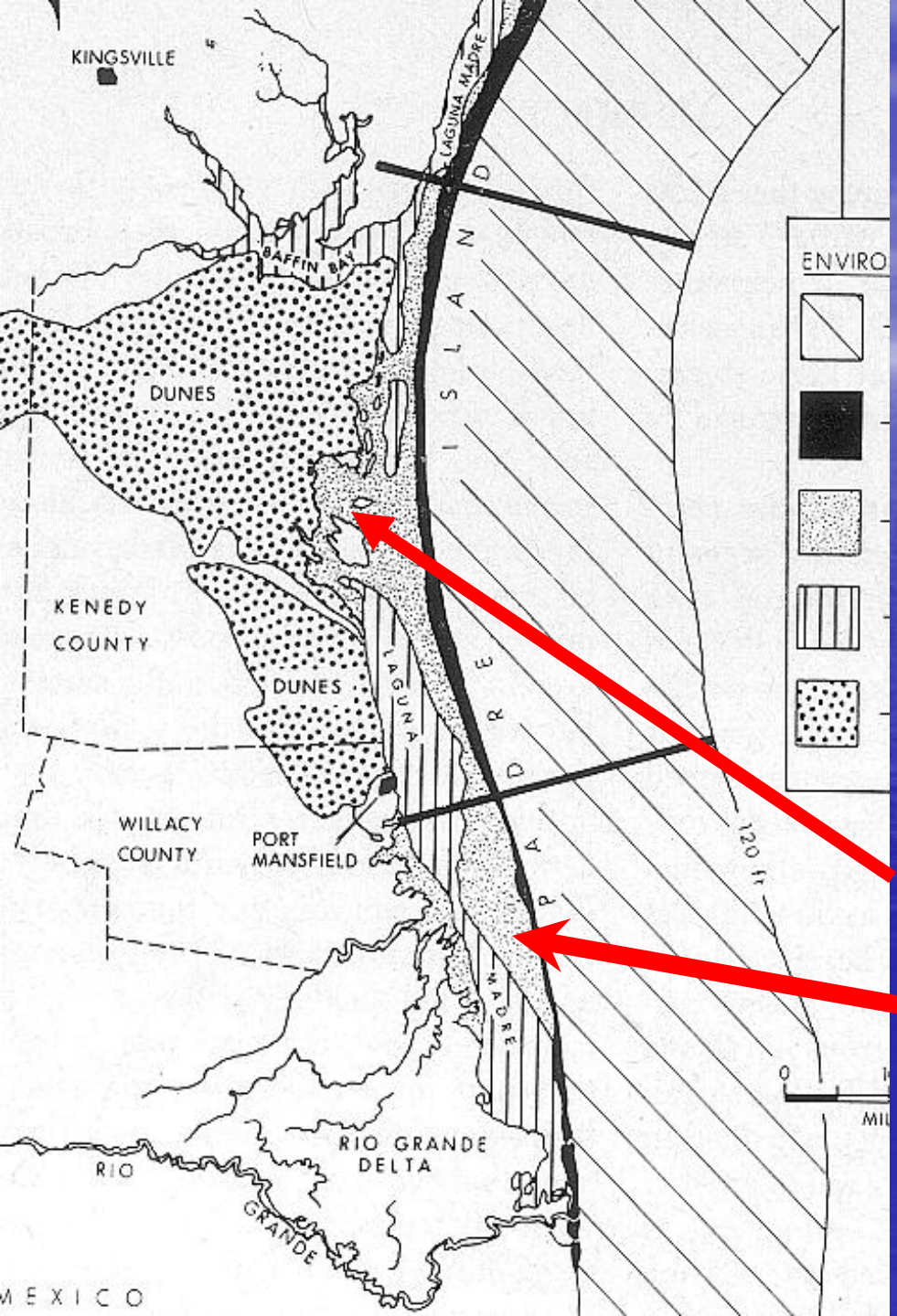
Central Padre Convergence, Accretion




Wind-Tidal Flats
TexasCoastGeology.com

Laguna Madre



Shallow Gulf

Barrier Island

Wind-Tidal Flat

Shallow Lagoon

Sand Dunes

Kenedy Flats

S. Padre Flats

TexasCoastGeology.com

Banner dune and low blow out area left in its path

Mansfield Pass 5/11/2006

Mansfield Pass, December 2008 after dredging

Mansfield Pass, September 2010

Mansfield Pass, September 2010

Packery Channel 9/23/2010

Packery Channel 9/23/2010

Packery Breaking 1/16/2008

Packery Breaking, April 2011

Cedar Bayou 1996

Cedar Bayou, October 2011

San Luis Pass Ebb Delta

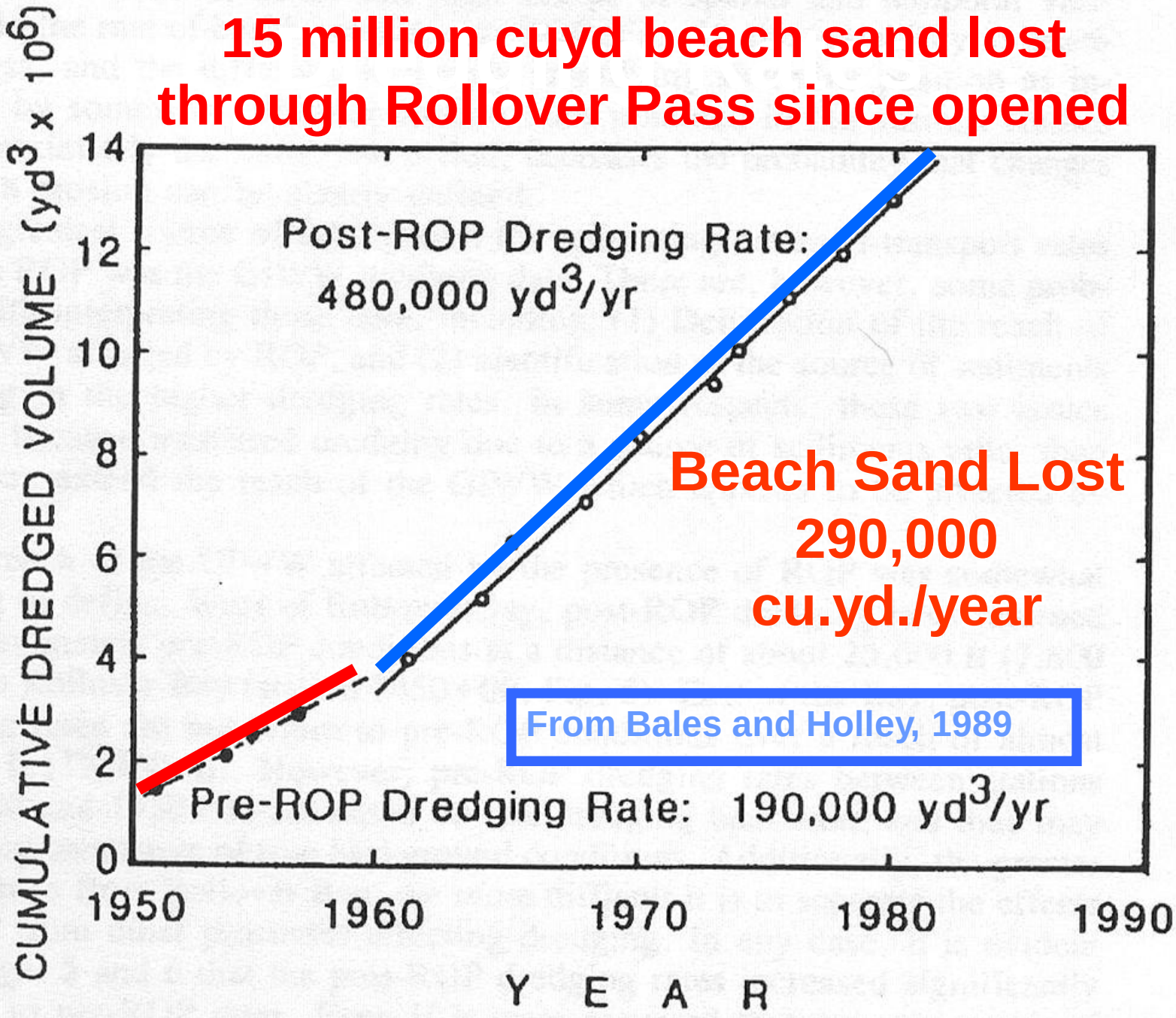
1995 Color Infrared, San Luis Pass

From Gibeaut, Texas BEG


Galveston East Jetty,
30 million cubic yards of sand stored
TexasCoastGeology.com


Red line shows erosion
due to loss of sand through
Rollover Pass.
TexasCoastGeology.com

15 million cuyd beach sand lost through Rollover Pass since opened



The Breakers,1906

The Breakers, 1995

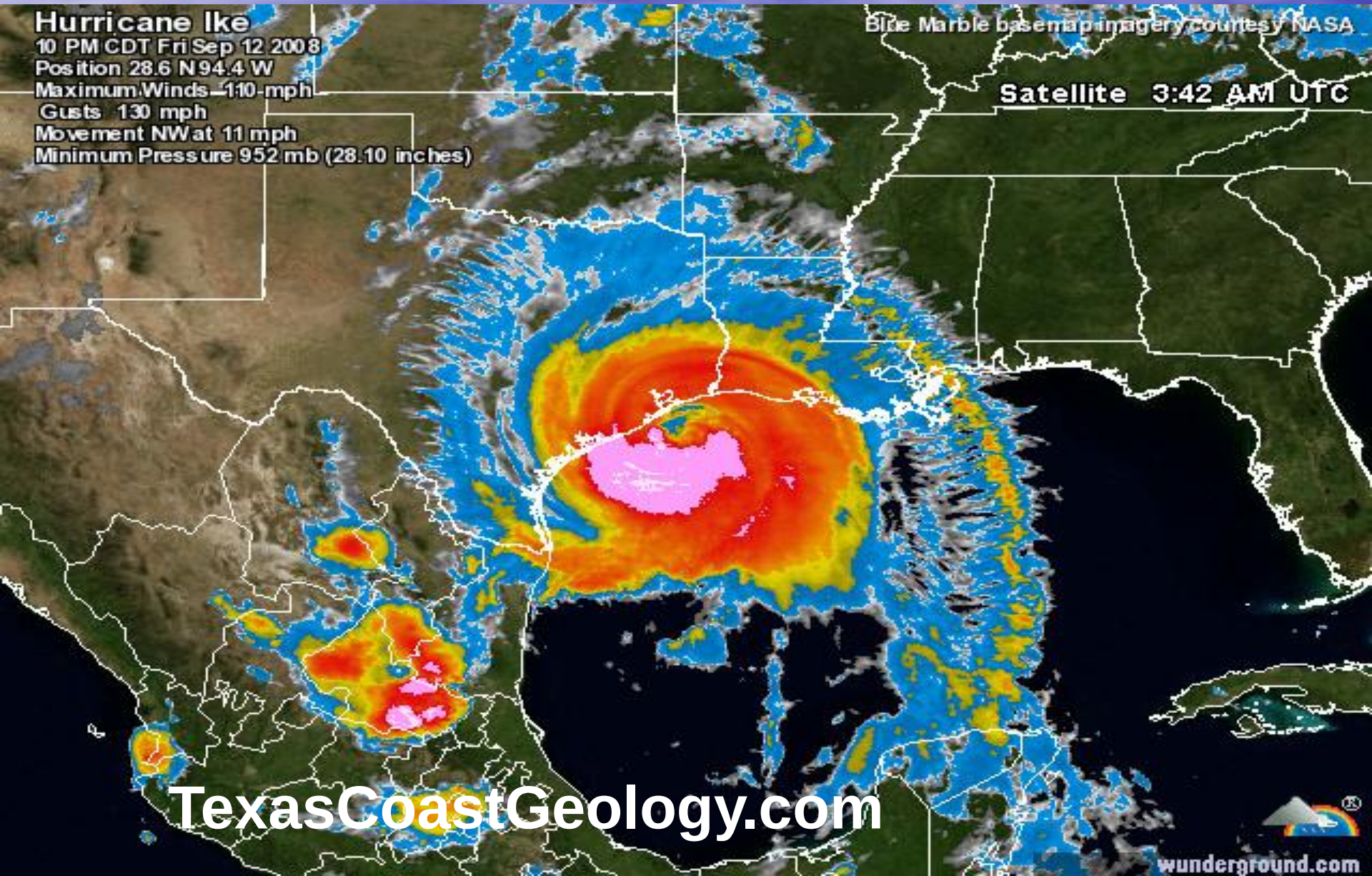
The Breakers, 1998

The Breakers before Ike

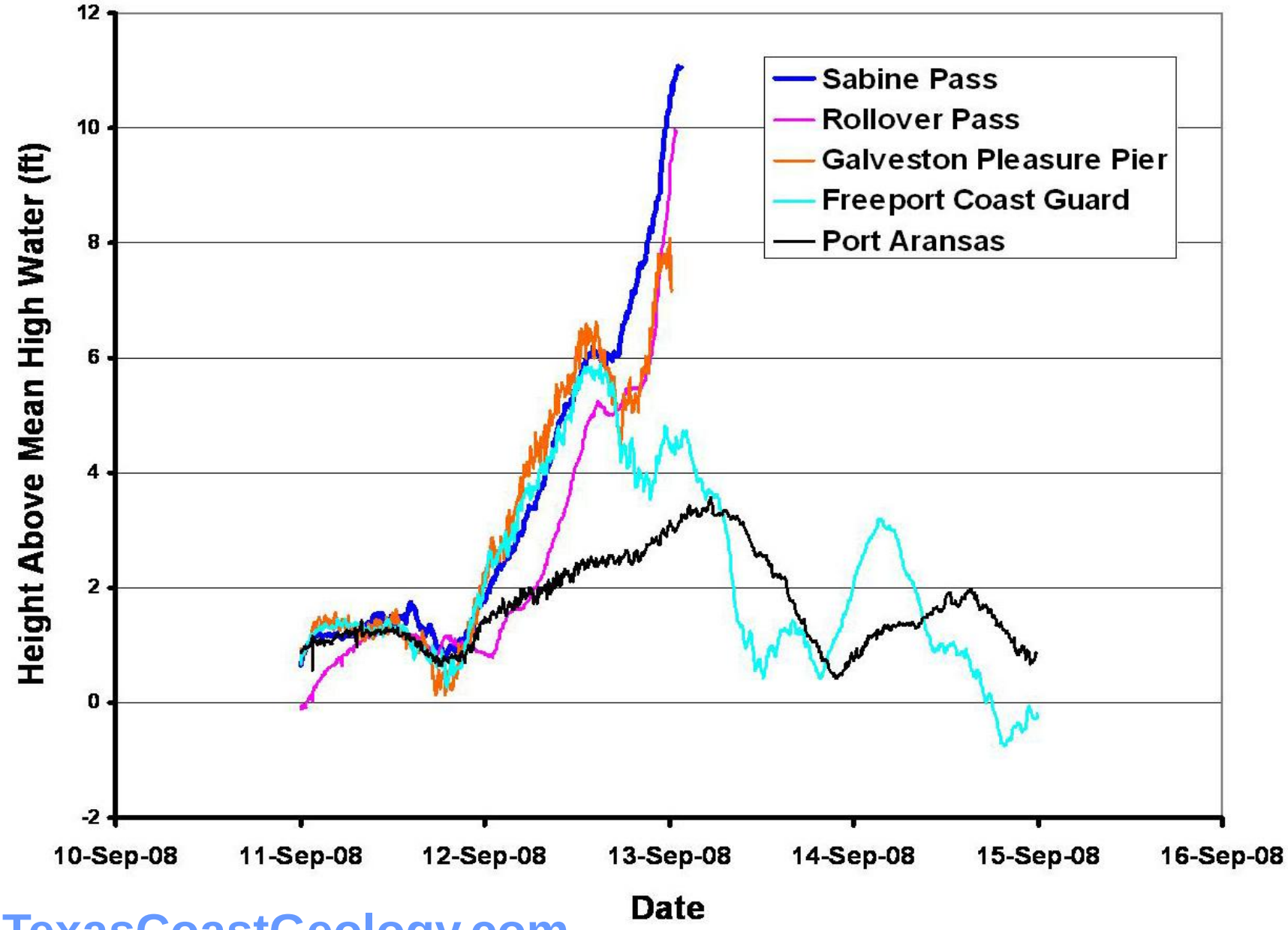
Google Earth

Ike Tropical Storm force winds 275 miles wide!

Ike's diameter was huge!

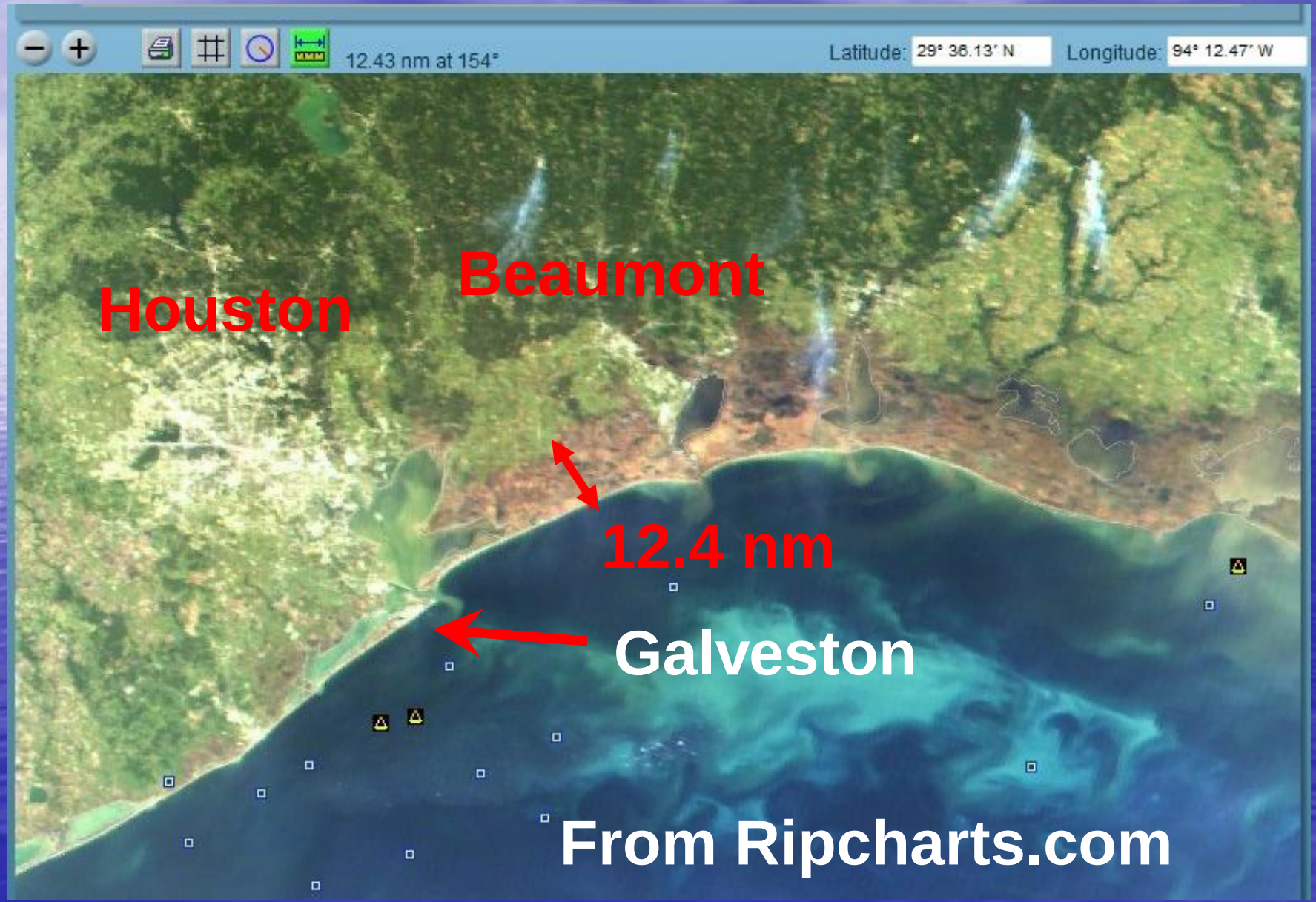


Hurricane Ike Surge



Gulf of Mexico Continental Shelf

Ike flooding on satellite photo



The Breakers after Ike

Rollover Pass, June 16, 2006

TexasCoastGeology.com

Rollover Pass, September 15, 2008

One house left in Gilchrist

Last House at Gilchrist, TX

Photo from TGLO

TexasCoastGeology.com

You have to be kidding!

TexasCoastGeology.com

They are called mobile homes

TexasCoastGeology.com


TexasCoastGeology.com

Even Ike can't kill Texas spirit!

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Surfside homes on beach Apr. 26, 2007

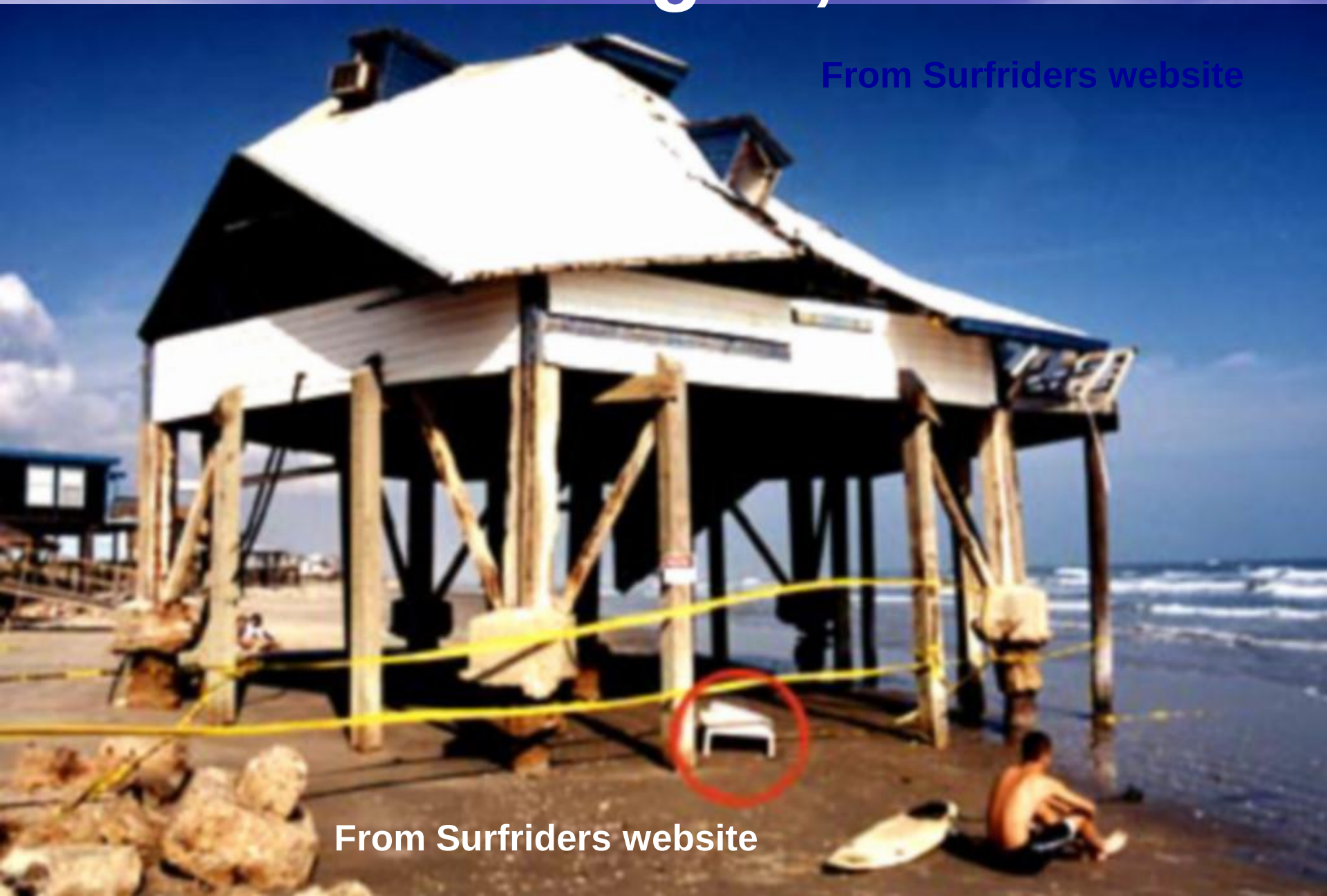
Surfside after Ike Oct. 28, 2008

The ramp shows where the dune was before the storm. New sand has been dumped to replace it.

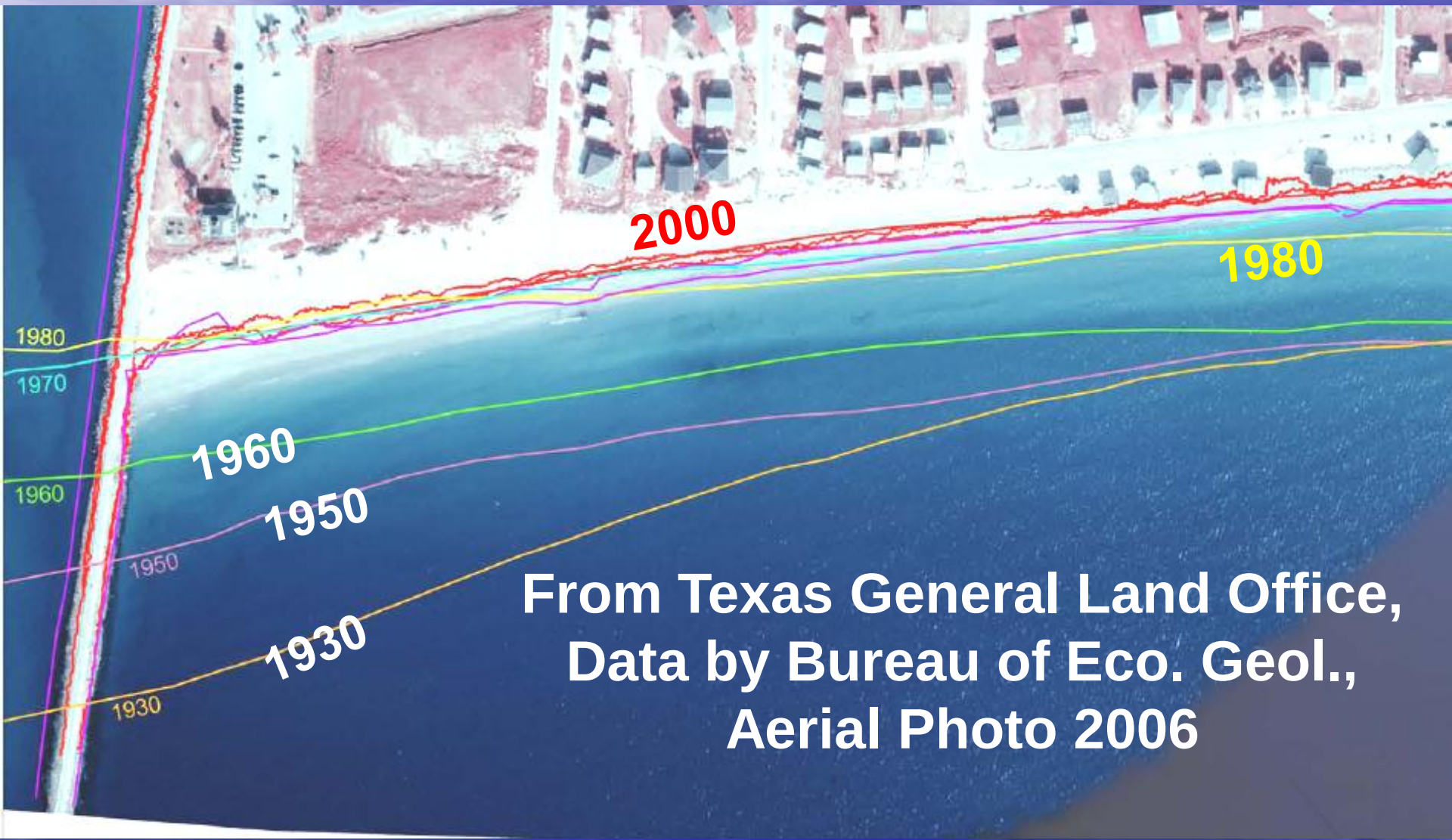
The Octagon, 1969

From Surfriders website

The Octagon, 2000



Historic Shorelines, Surfside



Freeport Jetties, Surfside

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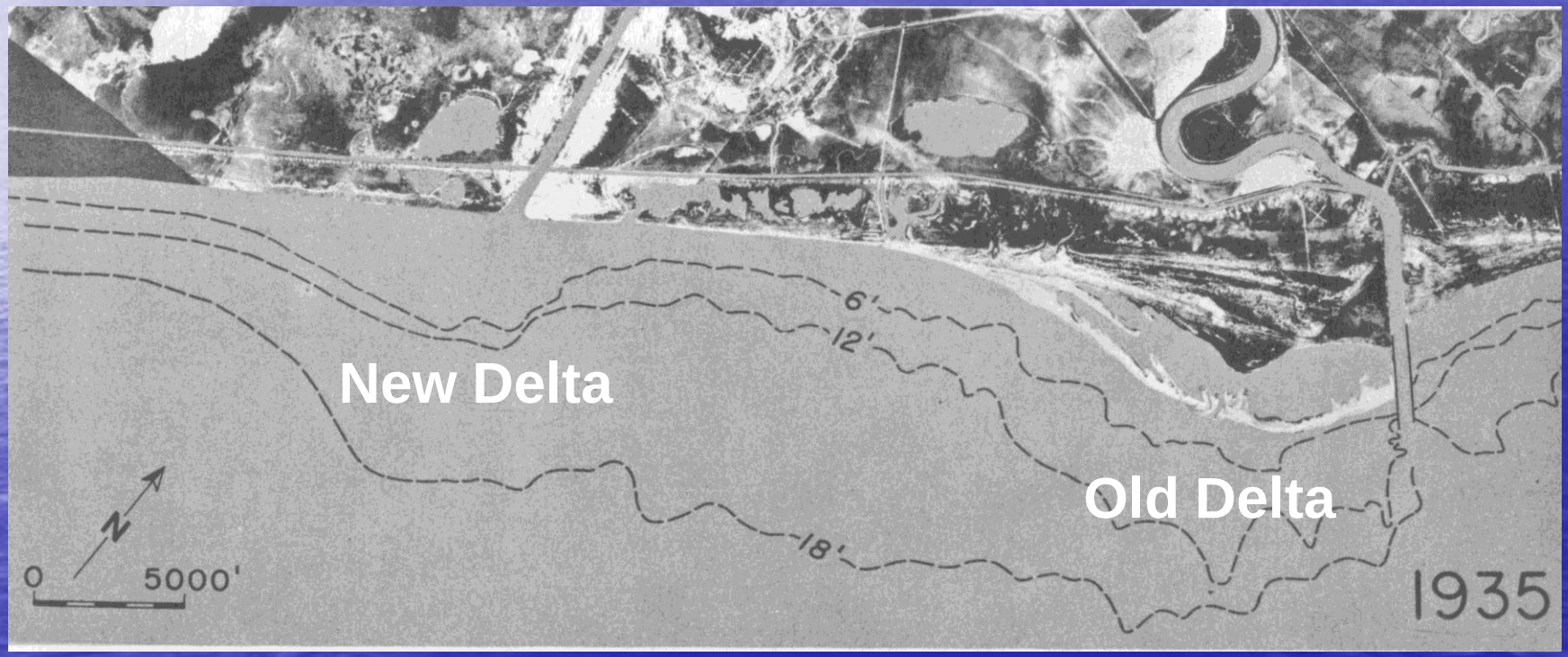
Brazos River Deltas 1935



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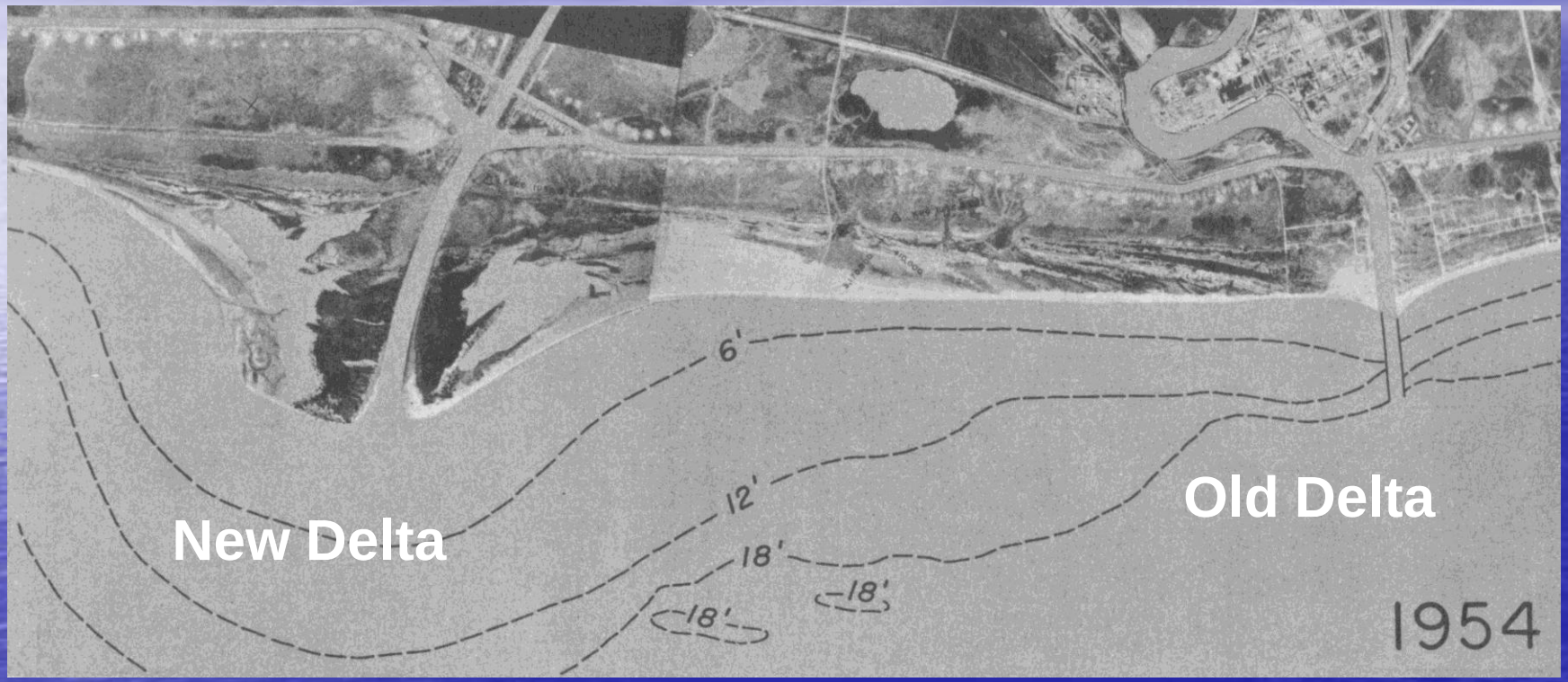
Brazos River Deltas 1939

FIGURE 9. -- BRAZOS RIVER DELTAS

(photos 12/18/38 to 1/20/39, uncontrolled mosaic, available at Galveston District, COE)

Brazos River Deltas 1954



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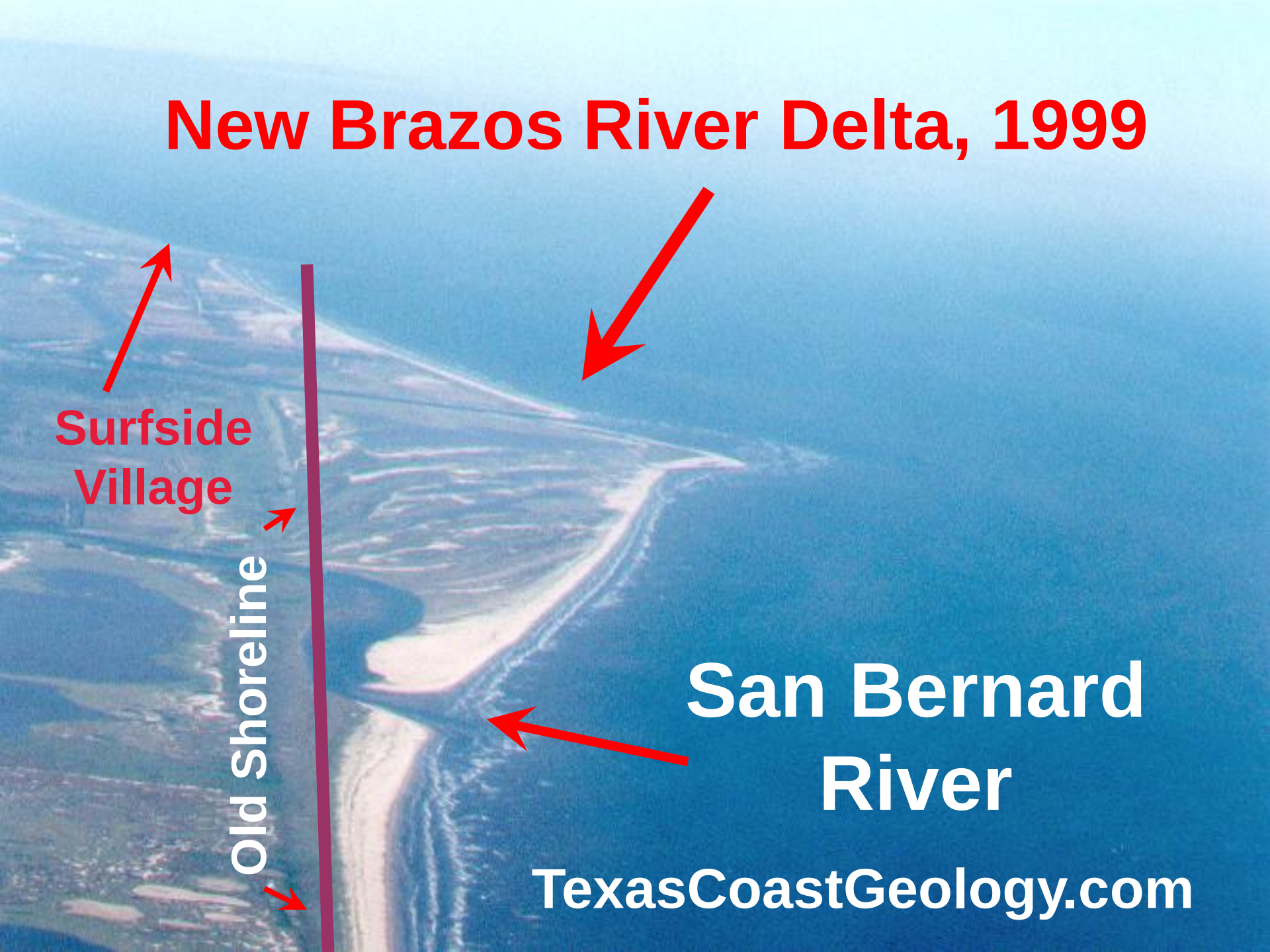
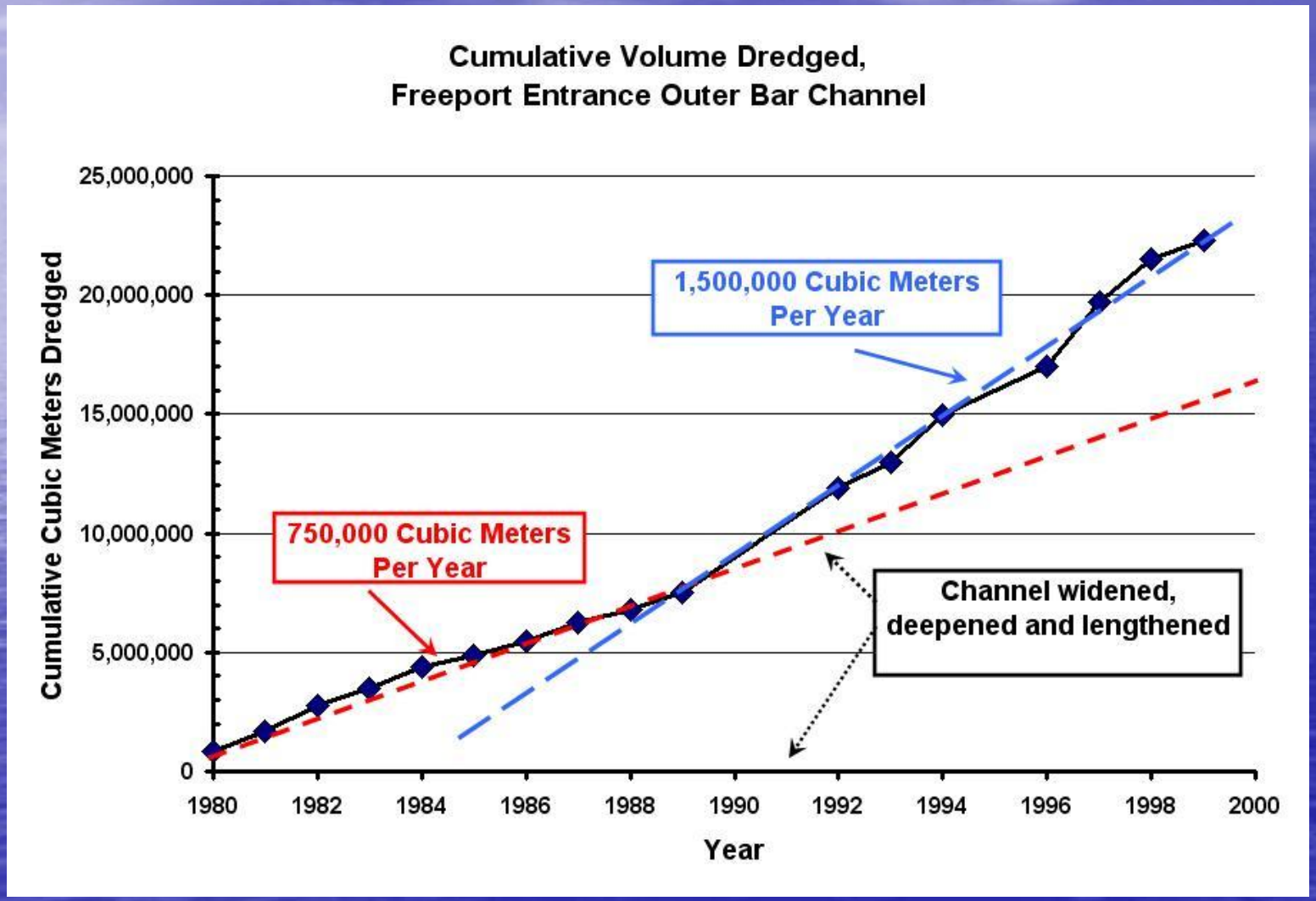

New Brazos River Delta, 1999
Surfside Village
Old Shoreline
San Bernard River
TexasCoastGeology.com

Brazos Deltas circa 2002

Freeport dredging doubled



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San Bernard River May 2006

Longshore drift moving from the upper right to the lower left has closed the mouth of the San Bernard River. The sand source is the new Brazos delta in the upper right of the photo.

San Bernard open again, Jan. 2007

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San Bernard River, March 2011

Port Aransas, Early 60s

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Pre-Jetty Foredune Ridge

TexasCoastGeology.com

Padre Seawall, 1970

Padre Seawall, 1996

Padre Seawall, Nov. 2005

Padre Seawall, 2007

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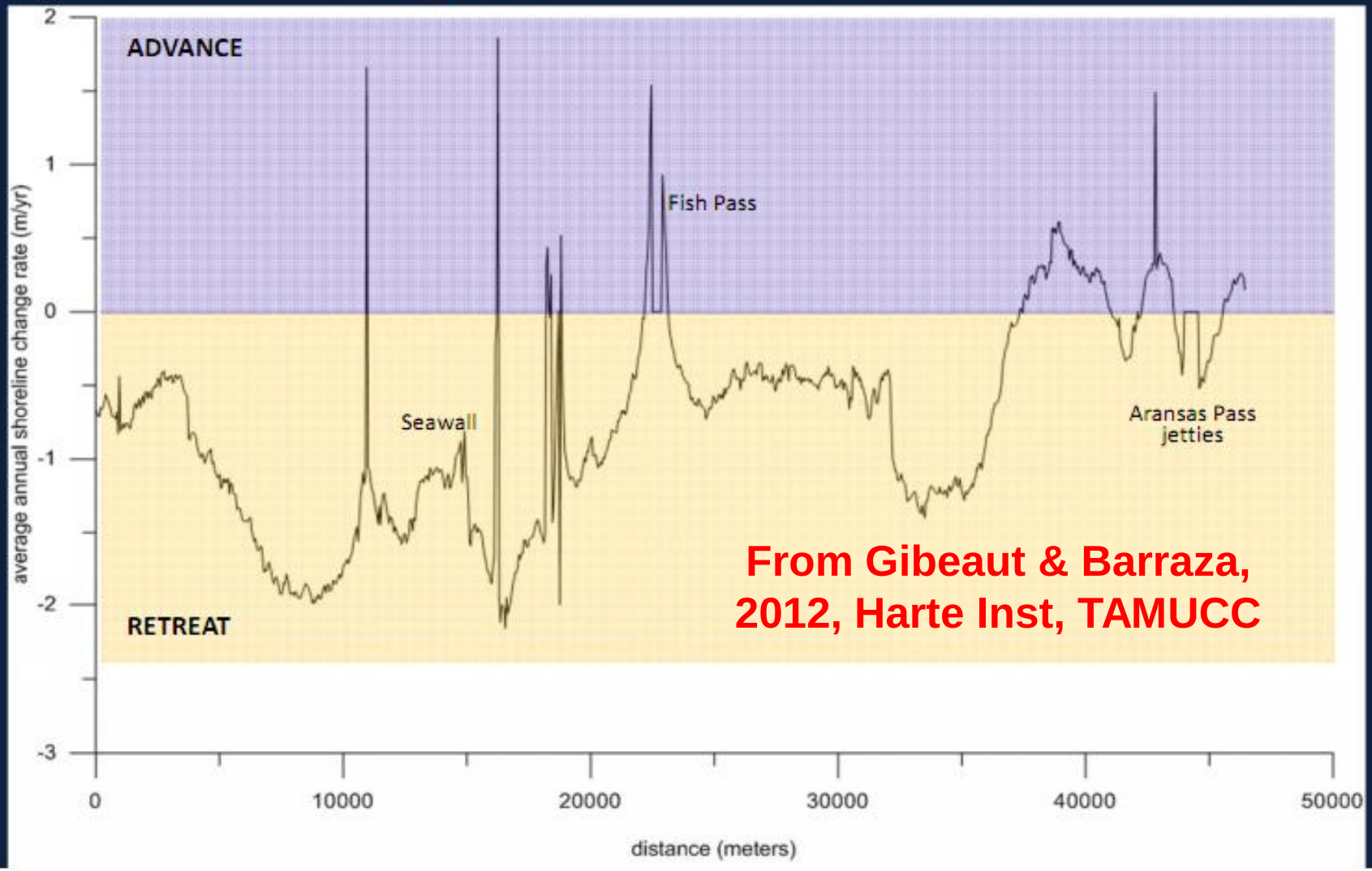
Shoreline change trend (1937-2005): Mustang and North Padre Islands



From Gibeaut & Barraza, 2012, Harte Inst, TAMUCC

Grain Size and Beach Steepness

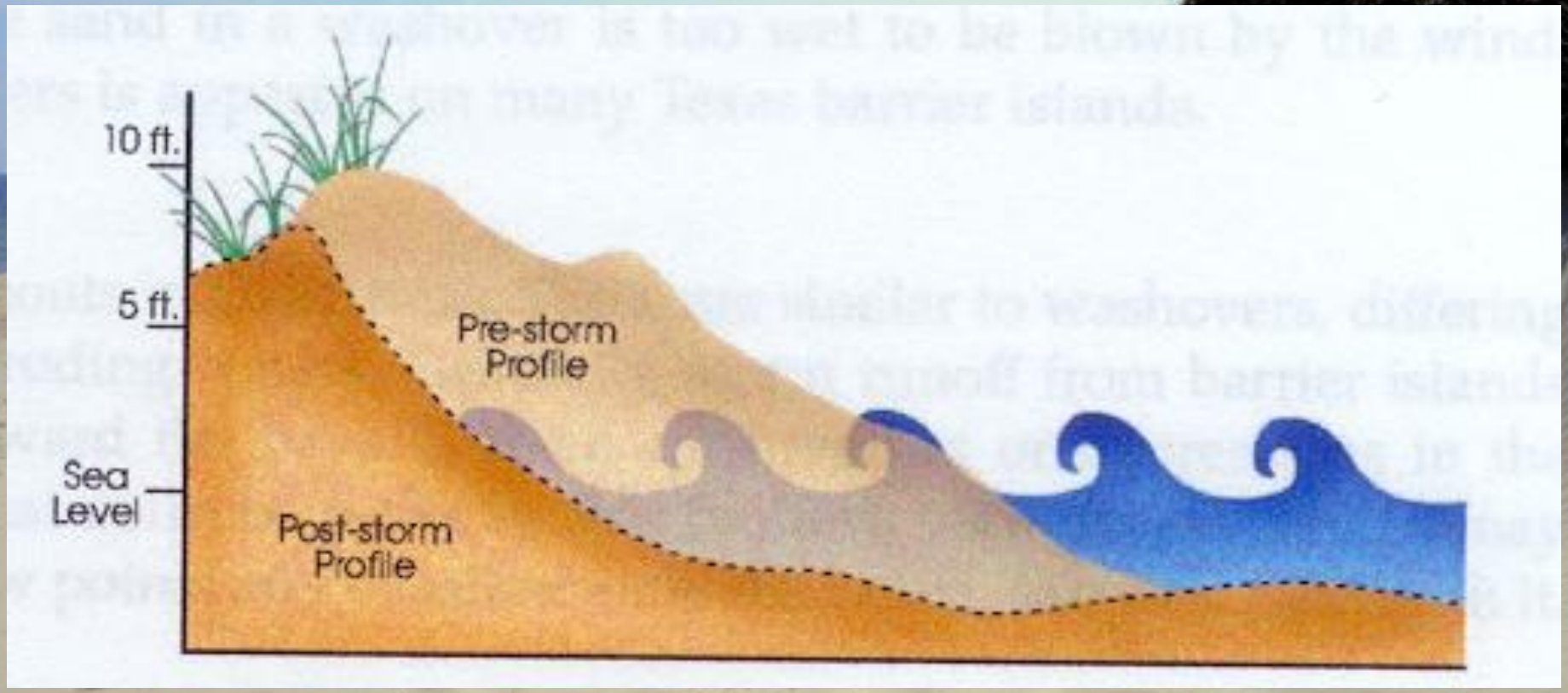
- Coarse material -- steep beaches
- Fine material -- low slope beaches
- Why -- The concept of grade
- It is the same in rivers
- This is a very useful concept when evaluating any system which transports sediment

Steep Cobble Beach, Hawaii

Wave Size and Beach Steepness

- Gentle waves form steep slope beaches
- Large waves form low slope beaches
- Again it is the concept of grade at work (Hoover Mackin)
- The available wave energy must be able to move the sediment both up and down the shoreface.

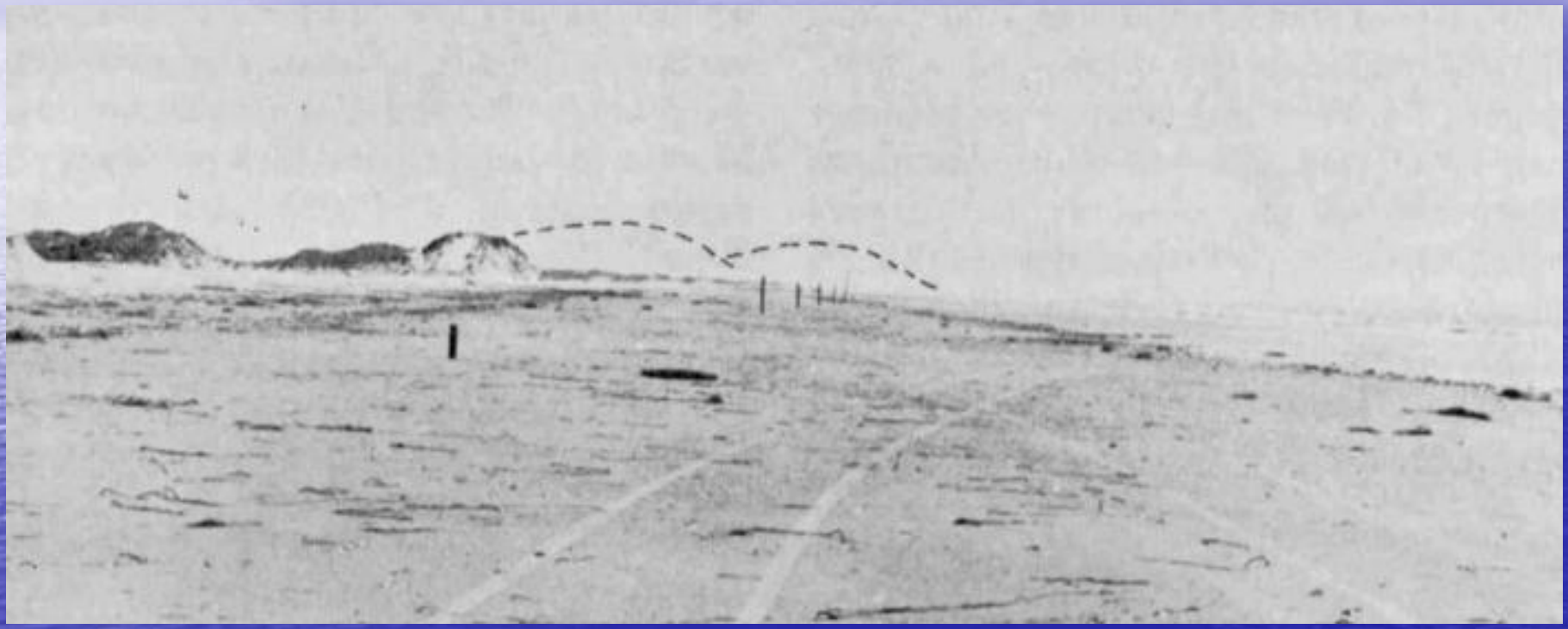
Storm Erosion of Dunes



Texas General Land Office (GLO)

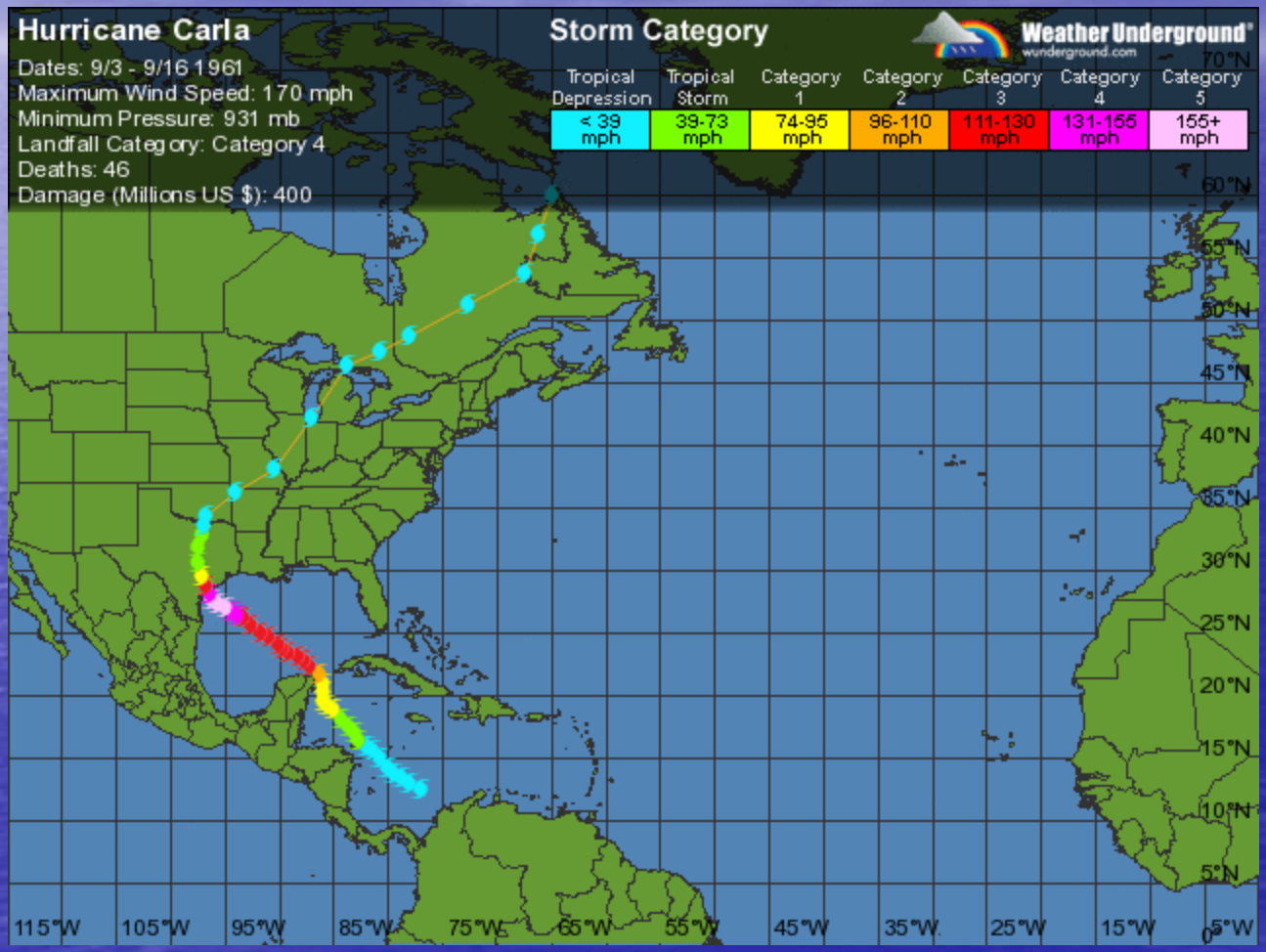
TexasCoastGeology.com

Dune Erosion by Carla, 1961

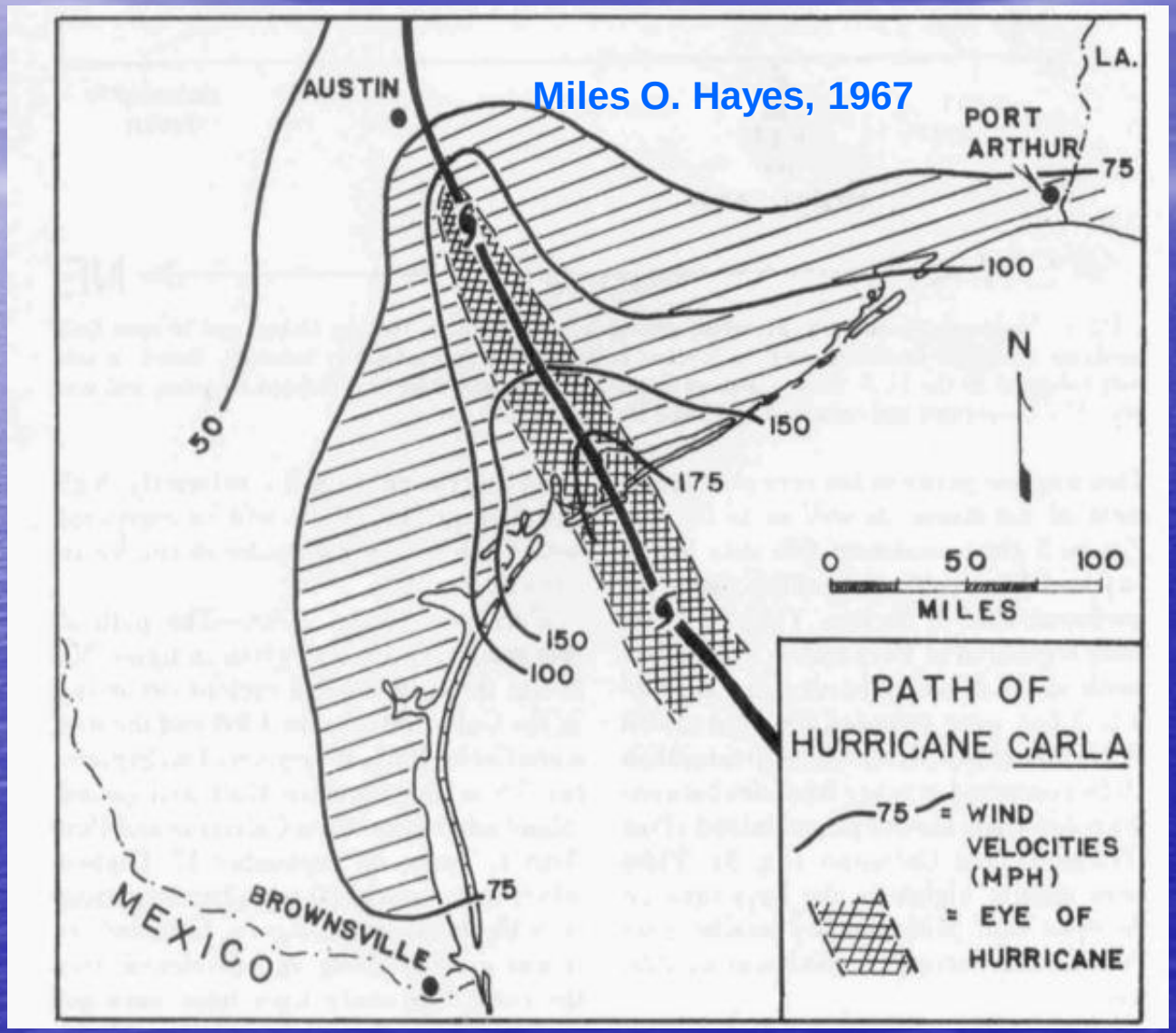


Miles O. Hayes, 1967

H. Carla 1961 Track



Hurricane Carla Wind Field, 1961



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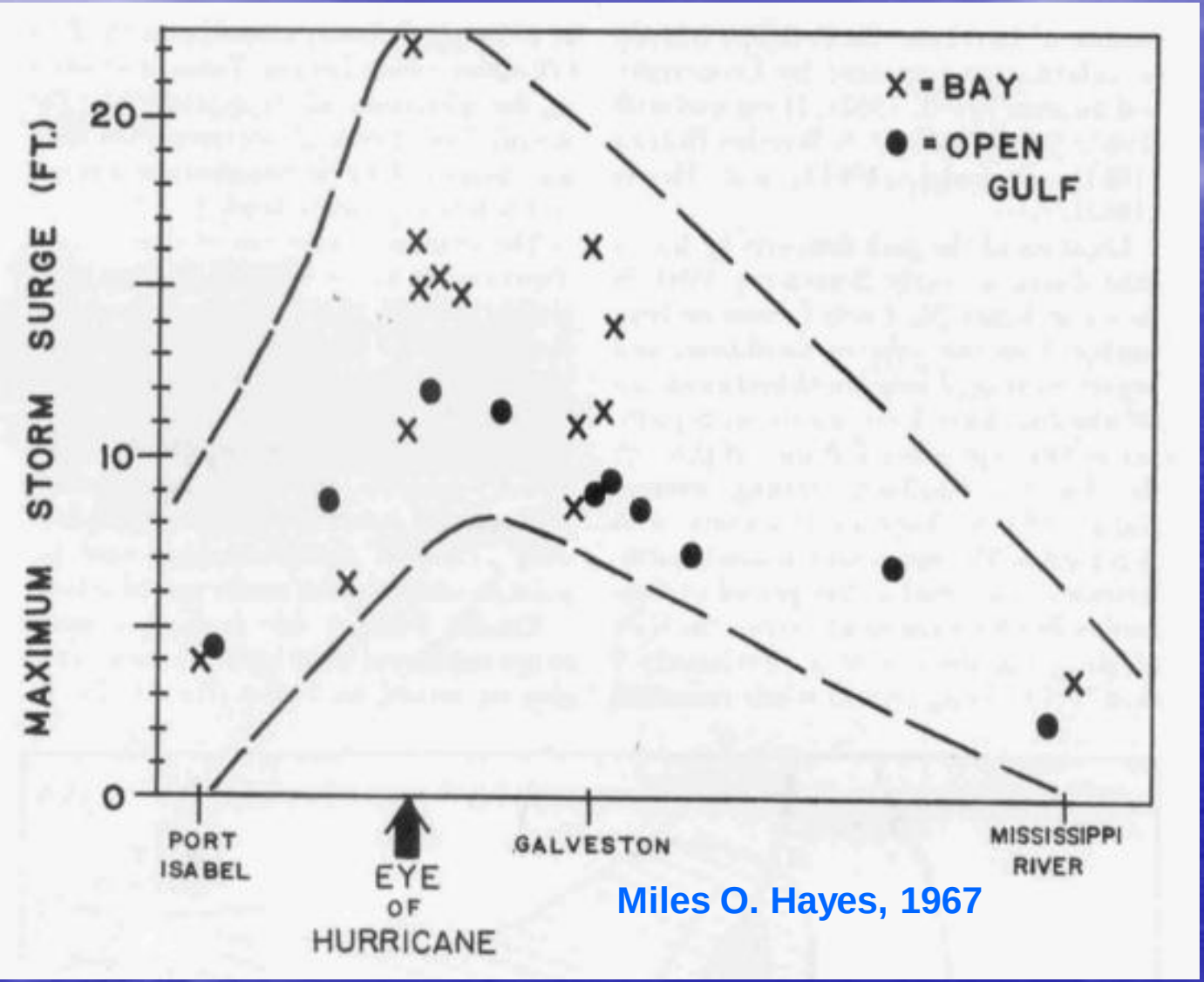
Hurricane Carla Surge, 1961



Miles O. Hayes, 1967

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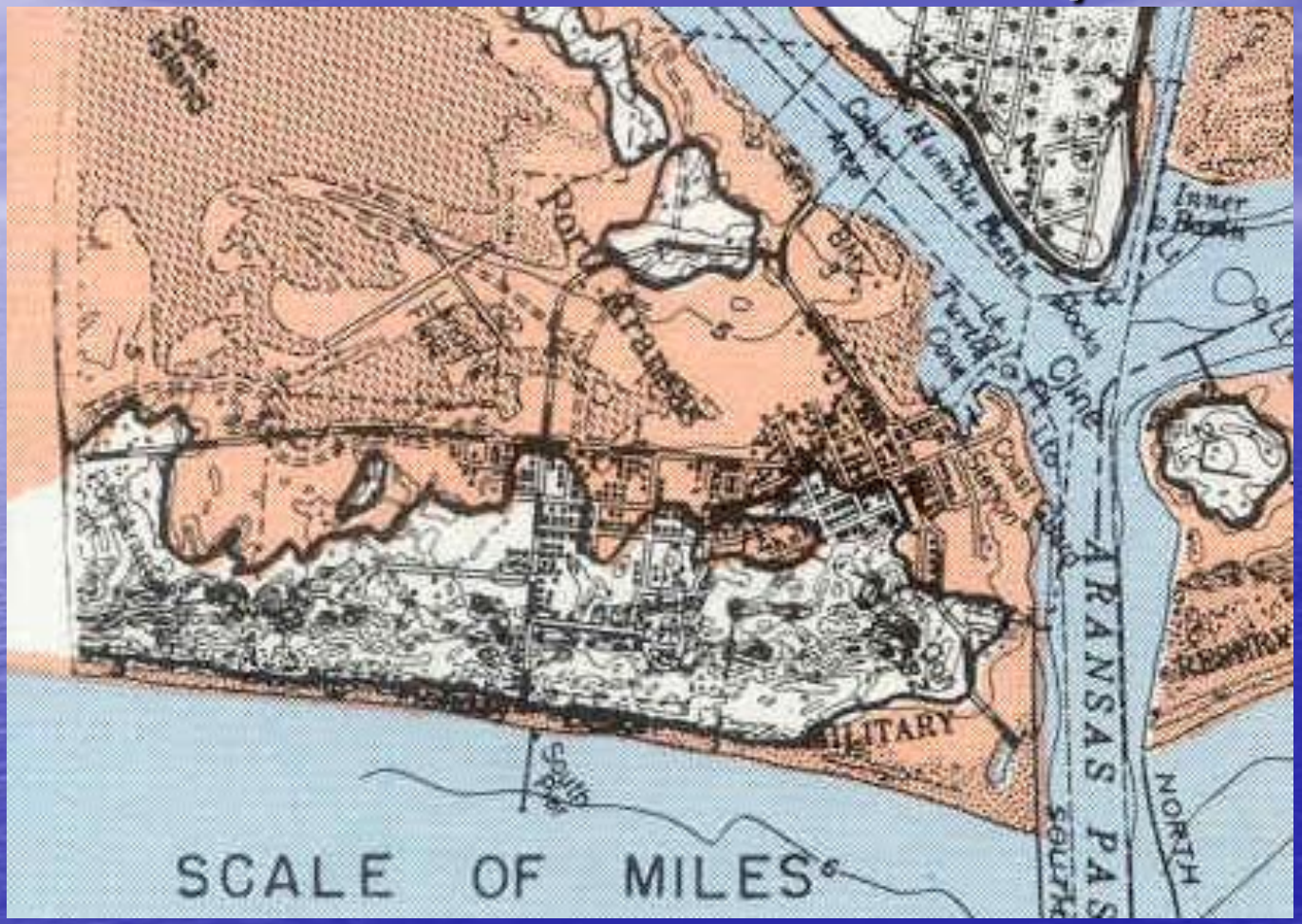
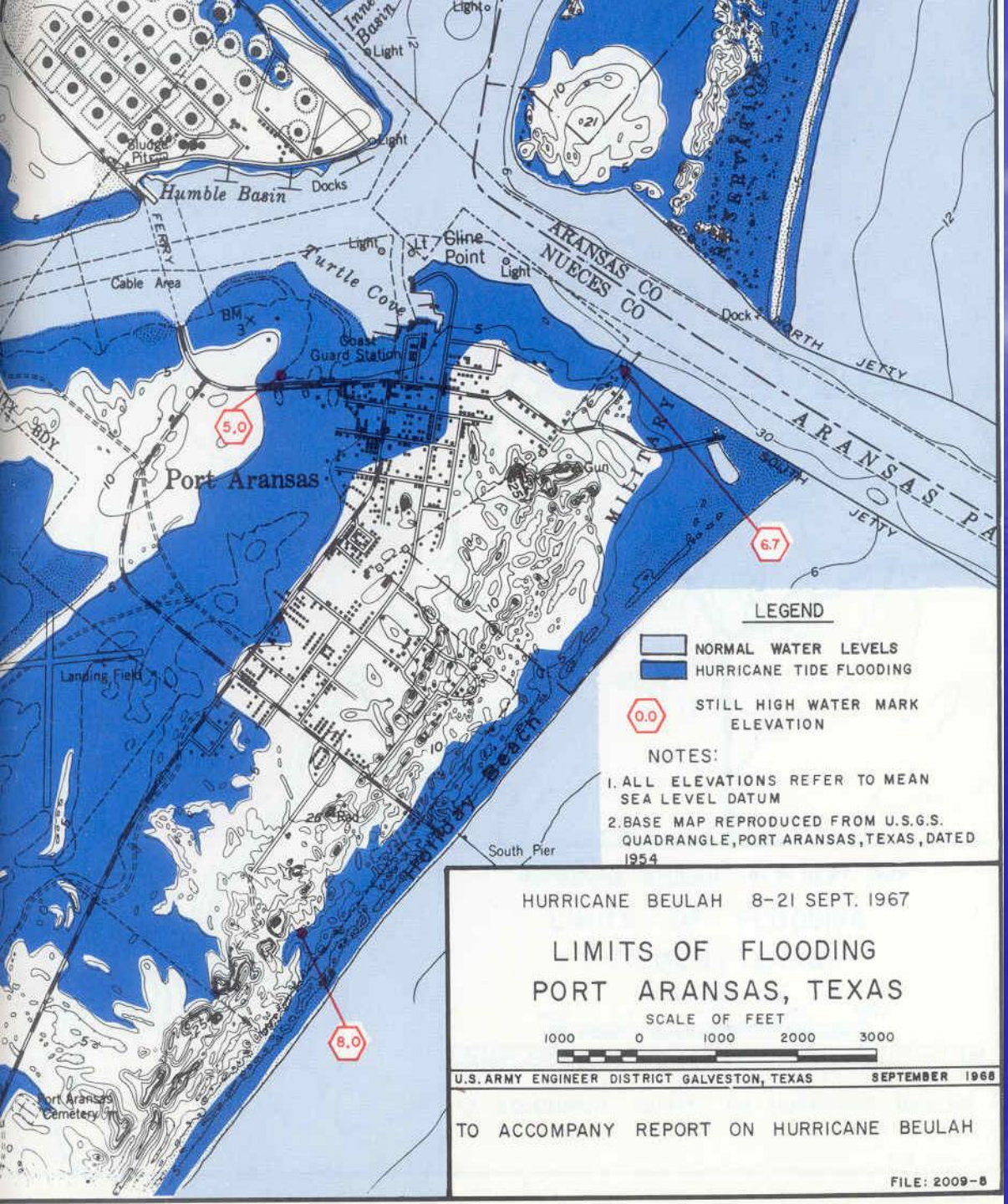
Hurricane Carla Inundation, 1961



Carla Surge 8-9 ft. at Port Aransas, dunes not breached



Hurricane Beulah Inundation 1967

Beulah surge about 8 ft., dunes not breached

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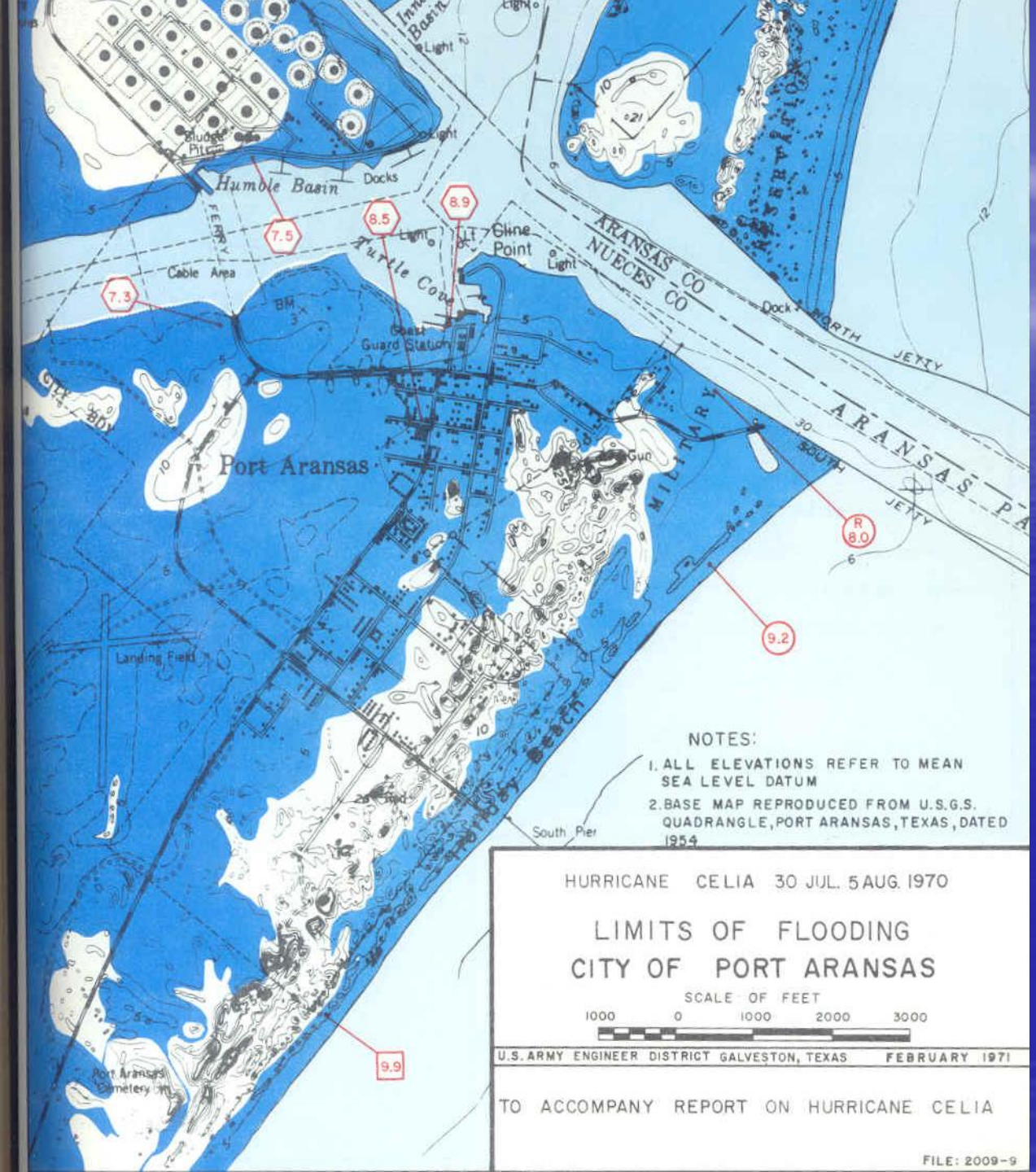

Hurricane Celia Inundation Port Aransas 1970

Celia surge at Port Aransas about 10 ft. Dunes not breached.

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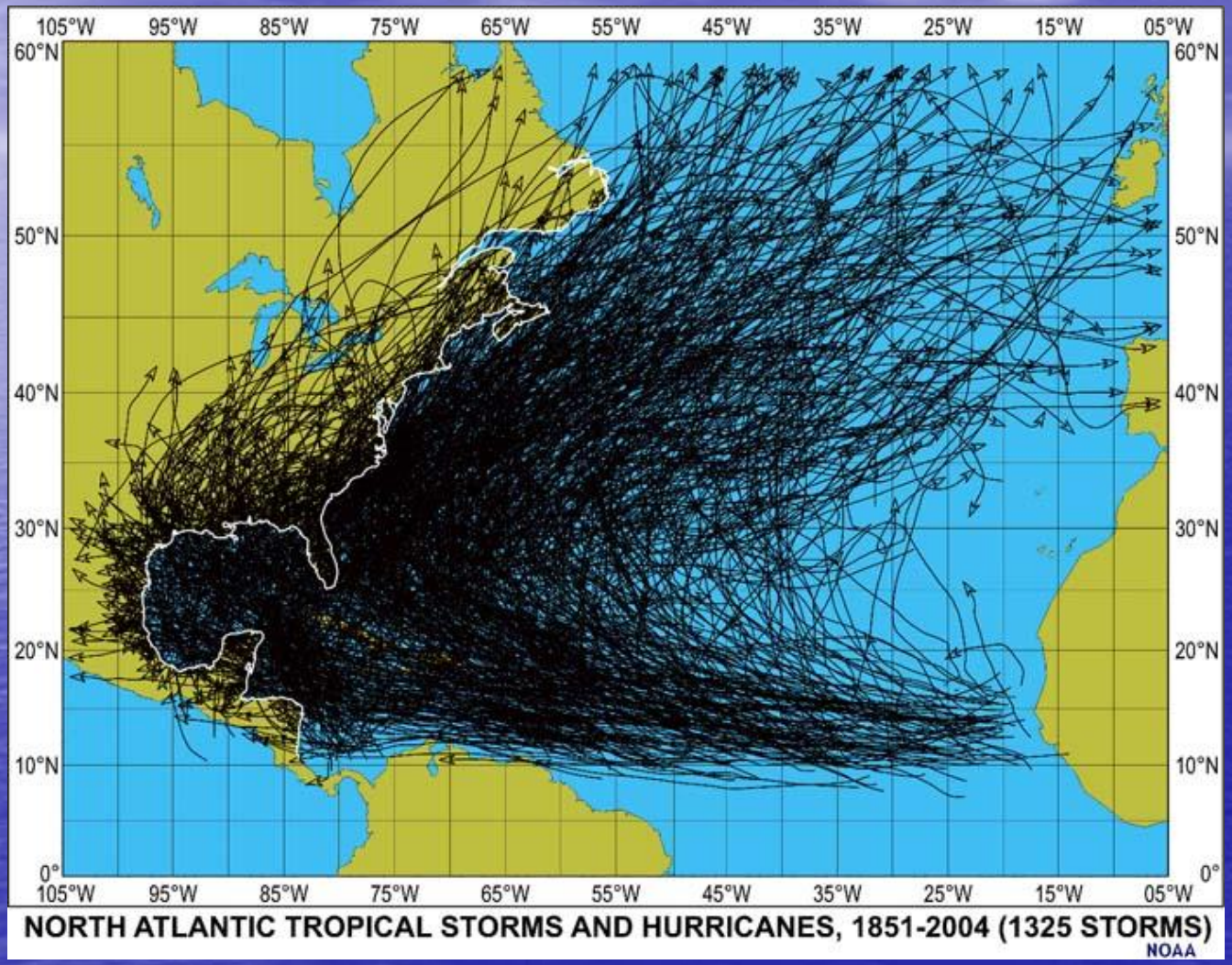
All Storms Since 1851



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Gulf Shorelines in Texas Are Retreating *Because*

- Long Jetties permanently trap sand, starving downdrift beaches and compartmentalizing the coast.
- Reservoirs trap river sand that previously flowed to the coast.
- Reservoirs reduce the maximum flood velocity of rivers.
- Sand is permanently lost through inlets.

Gulf Shorelines in Texas Are Retreating *Because*

- River mouths have been diverted, moving the delta to a new location.
- Rivers have been diverted from the Gulf into the bays.
- The Rio Grande has been turned off.
- Groundwater extraction has caused subsidence.
- Sea level rise moves shorelines landward.

WASHOVER FAN

TexasCoastGeology.com

Tombolos at TAMUCC Beach

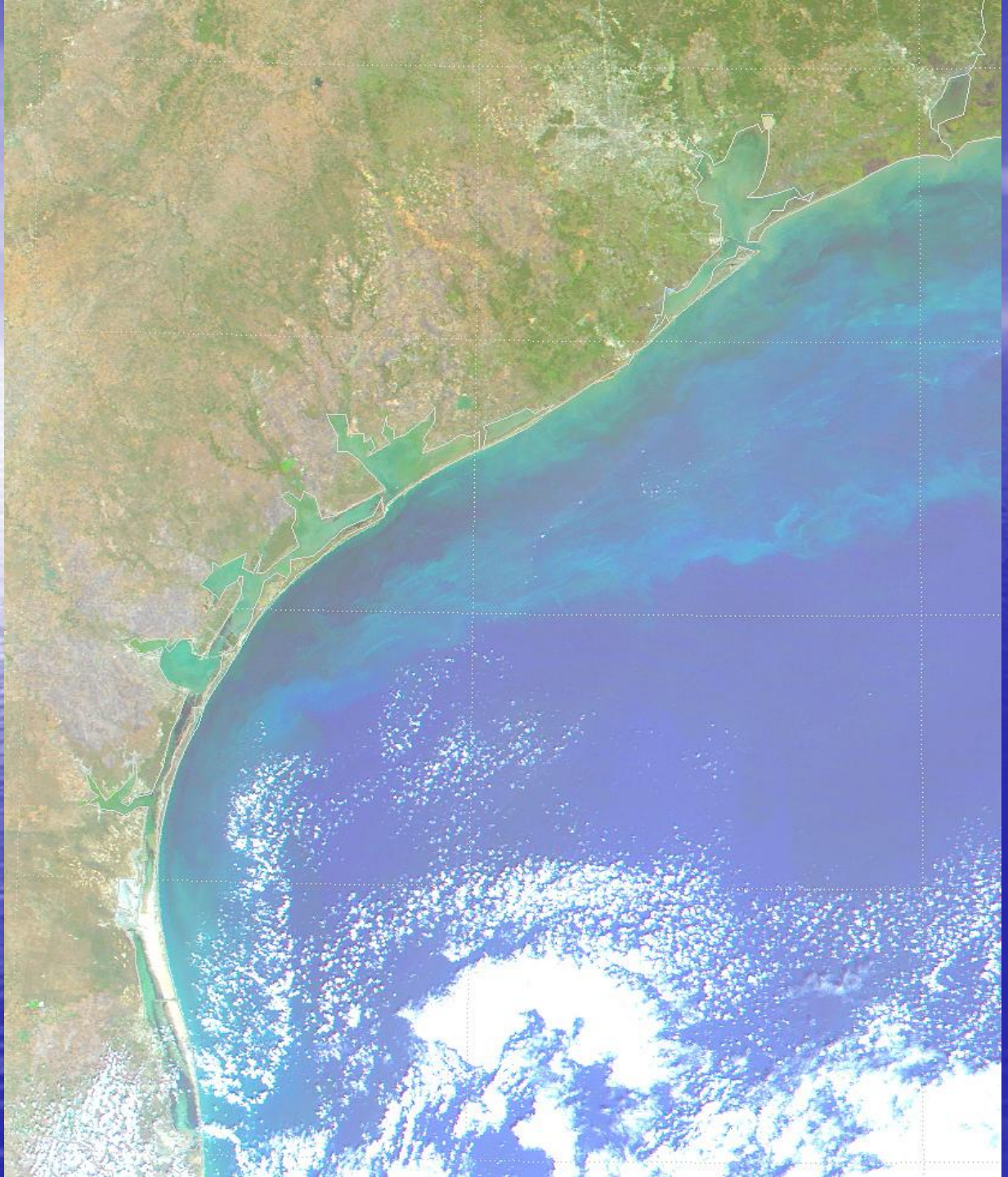
Breakwater Tombolos, La.

Don’t park too close to the water

TexasCoastGeology.com

Vegetated Coppice Dune

TexasCoastGeology.com



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