Coastal Processes and Equilibrium

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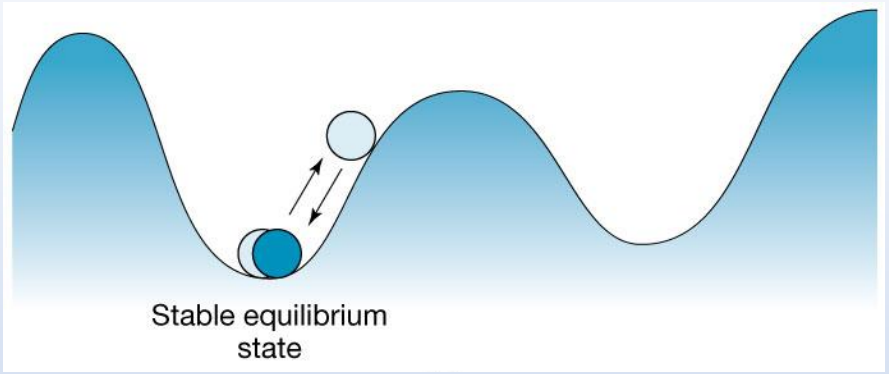
Ideas to take home with you:

- Equilibrium: Stasis and Change
- Coastal Processes
- What is there to do?

Equilibrium

- Equilibrium States:

1



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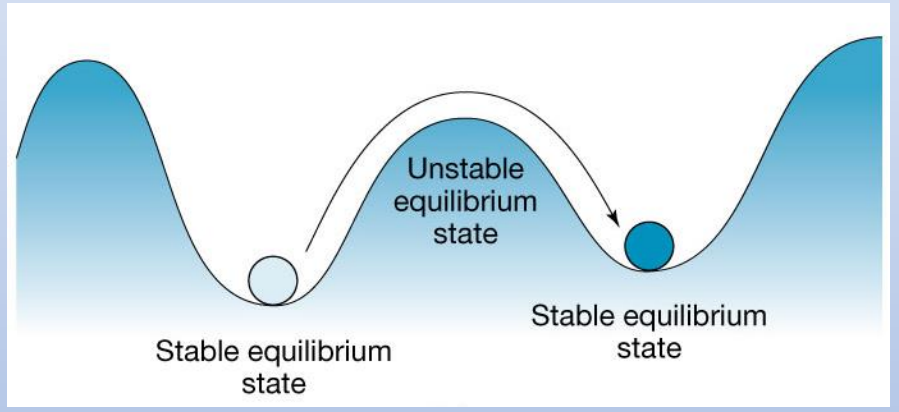

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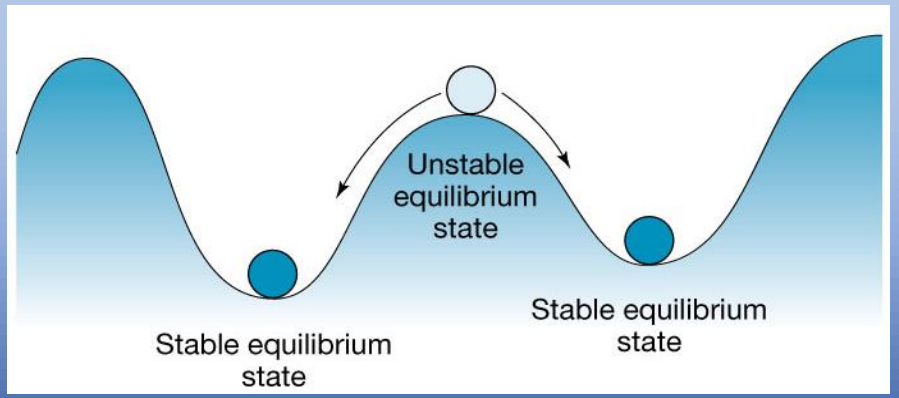
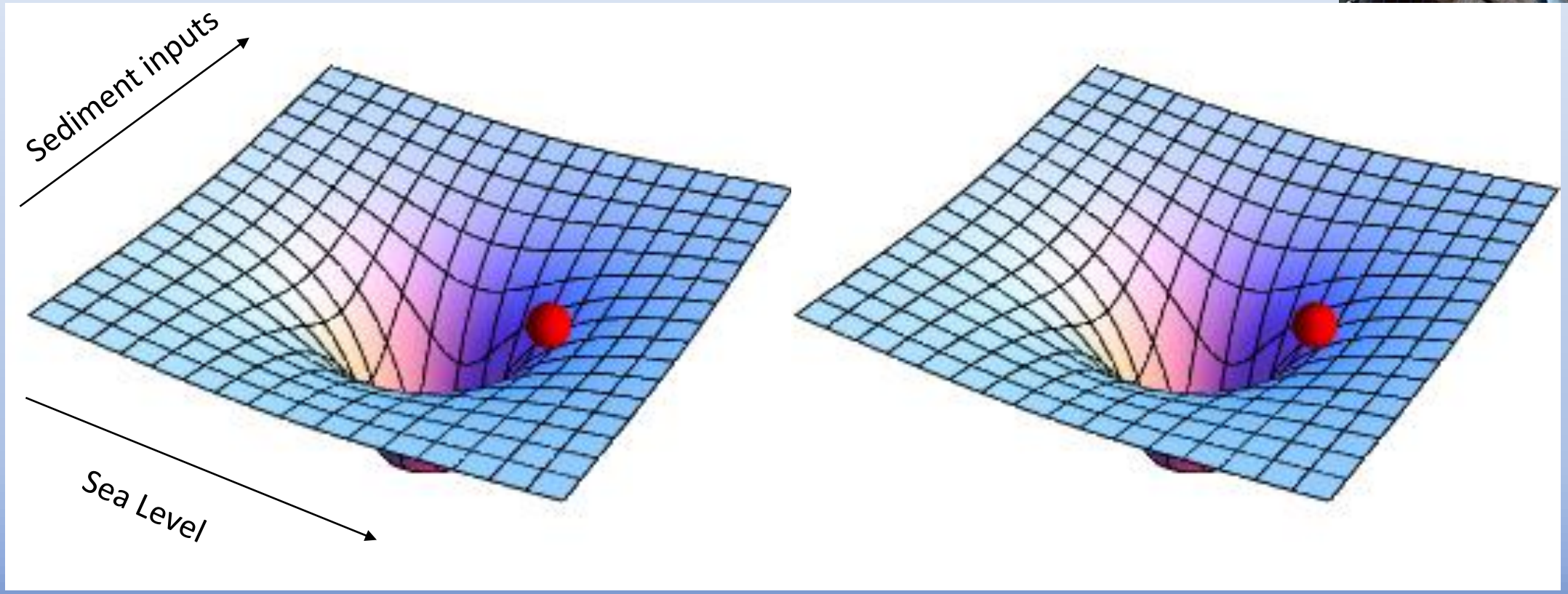
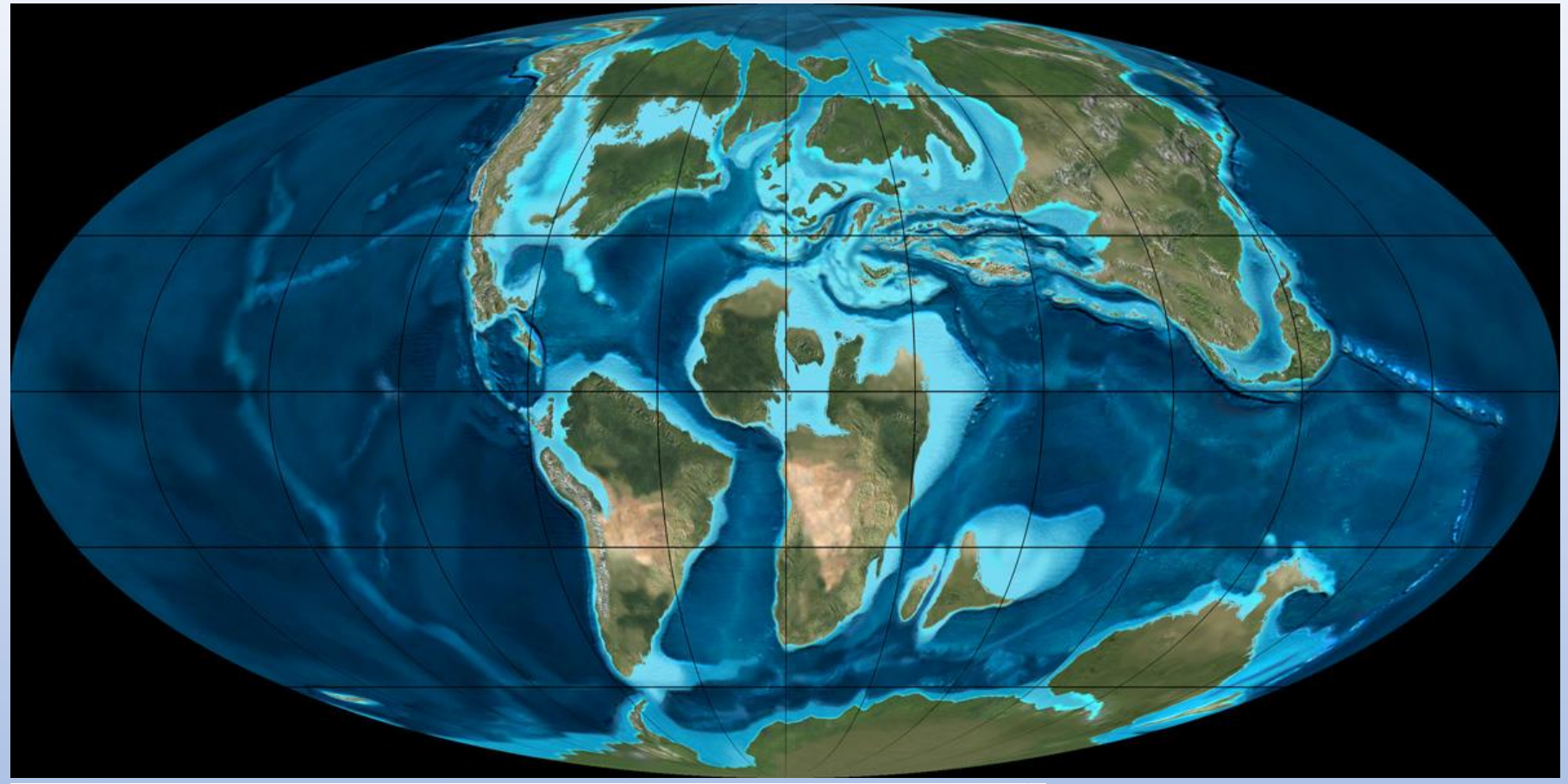
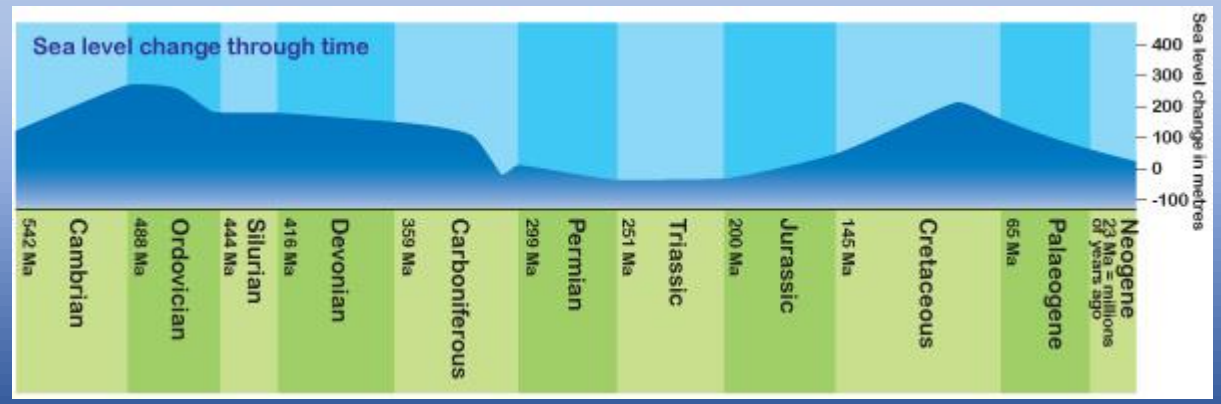


Equilibrium states (now in 3D!)



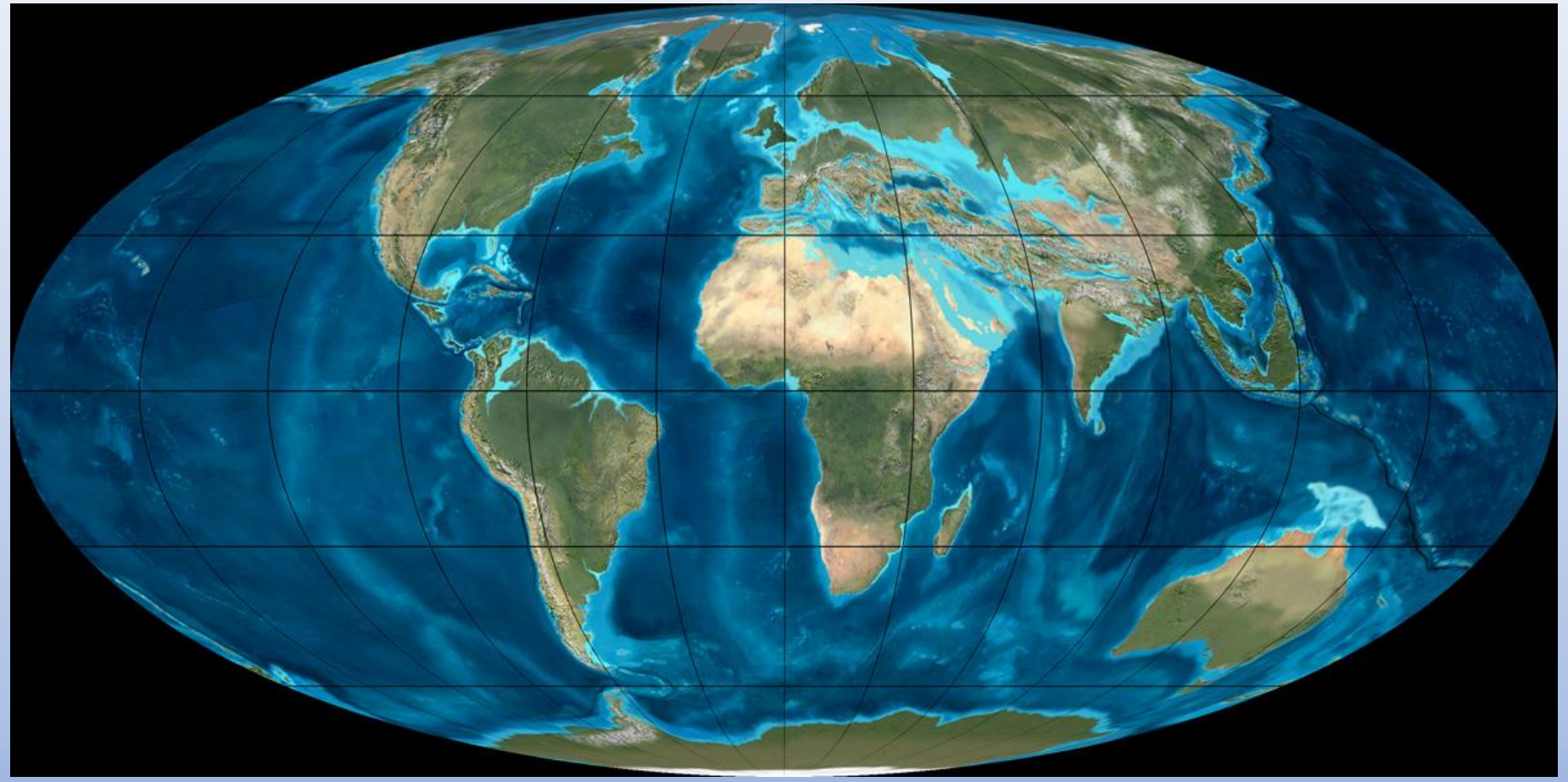
Mid Cretaceous 90 mya



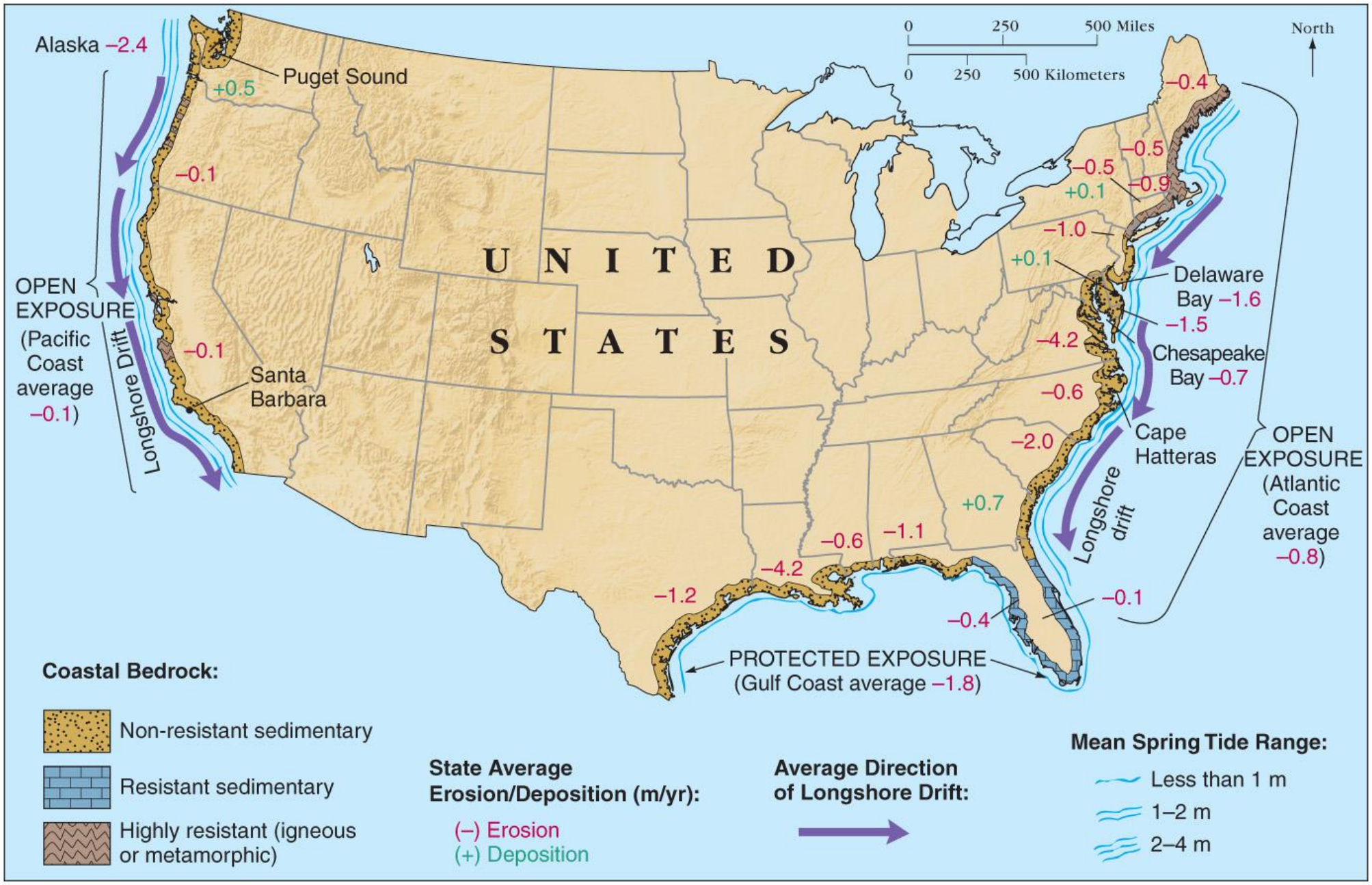


220 meters higher

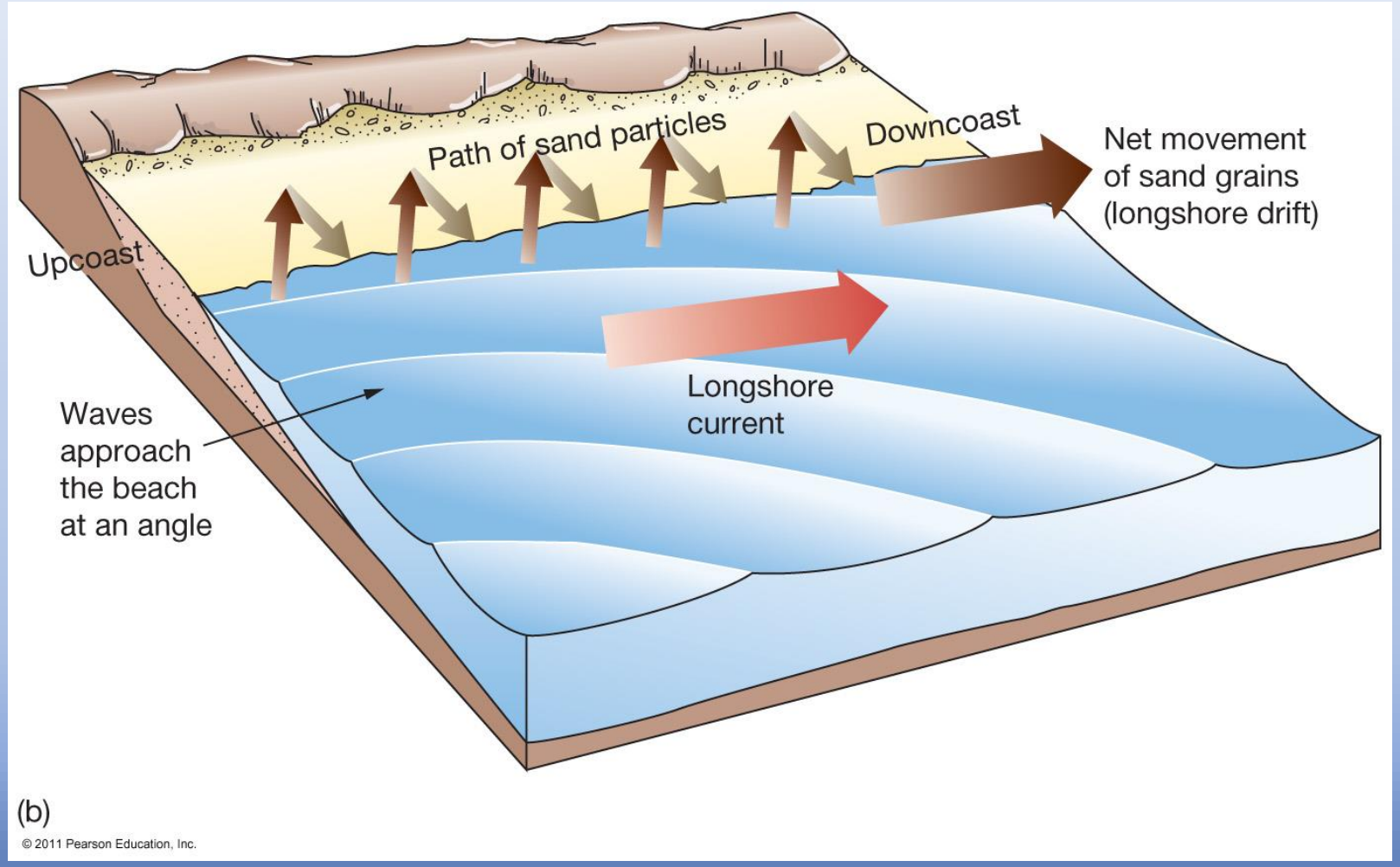
Neogene: 23 million years ago



~ 10m or 33 ft higher

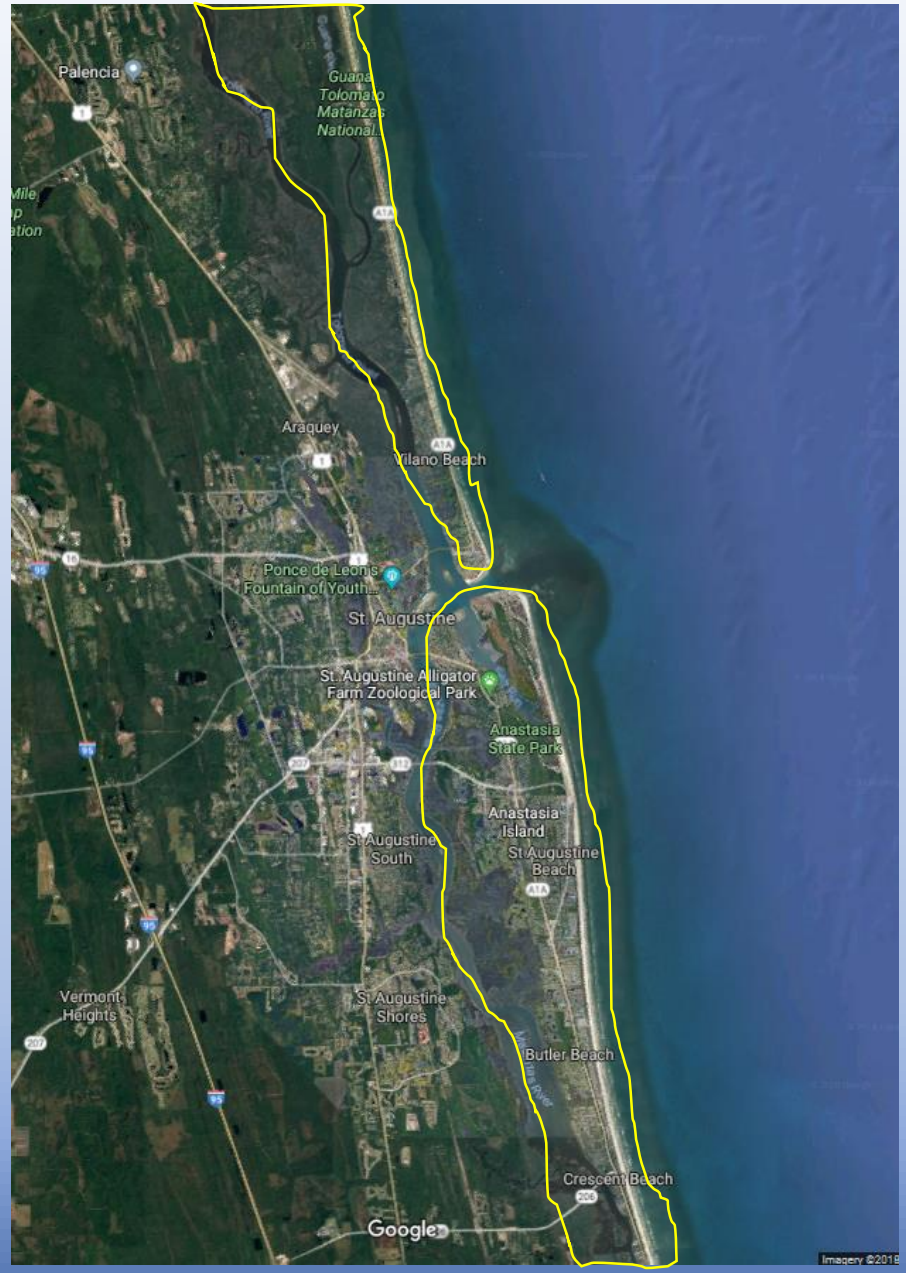


Longshore Transport



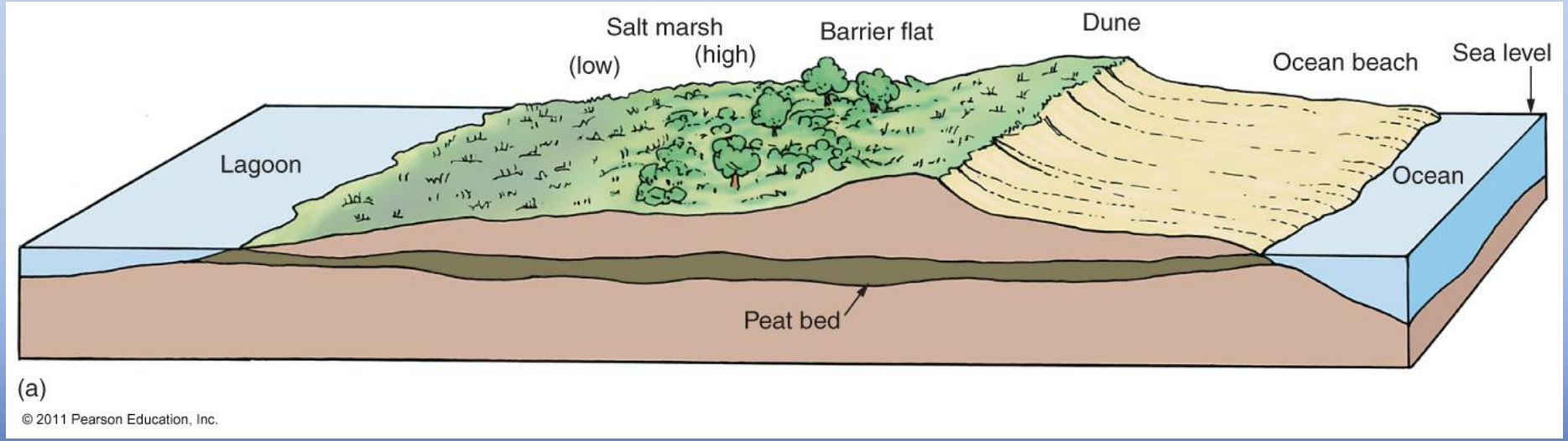
Barrier Islands

- Common along East and Gulf coasts of the United States
- Protect mainland from high wave activity
- Can migrate landward or seaward over time



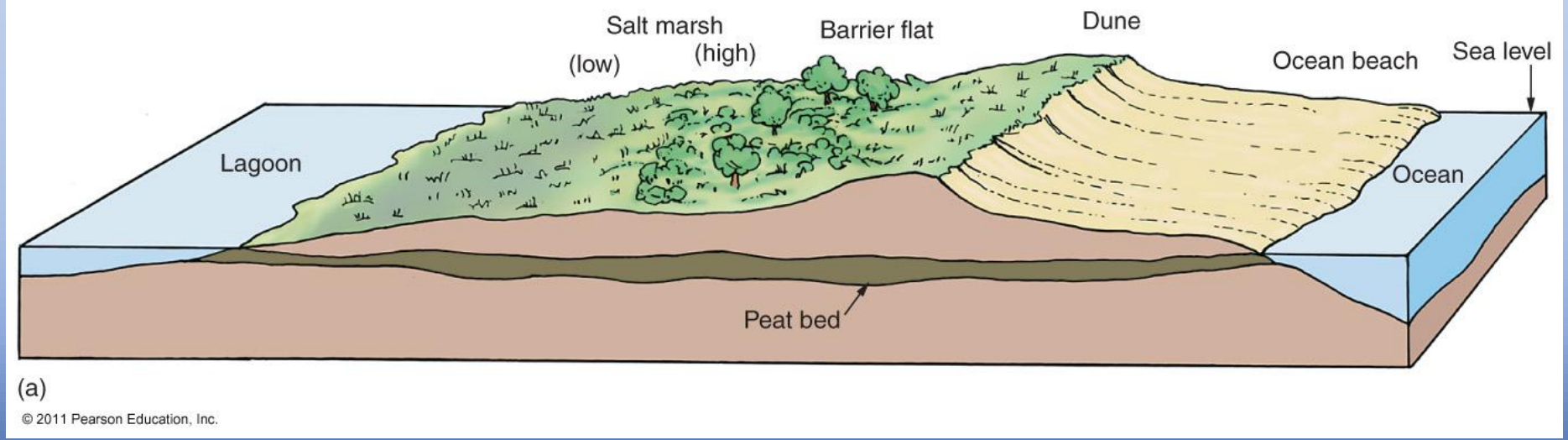
Barrier Island Anatomy

- Ocean beach
- Dunes
- Barrier flat
- High salt marsh
- Low salt marsh
- Lagoon



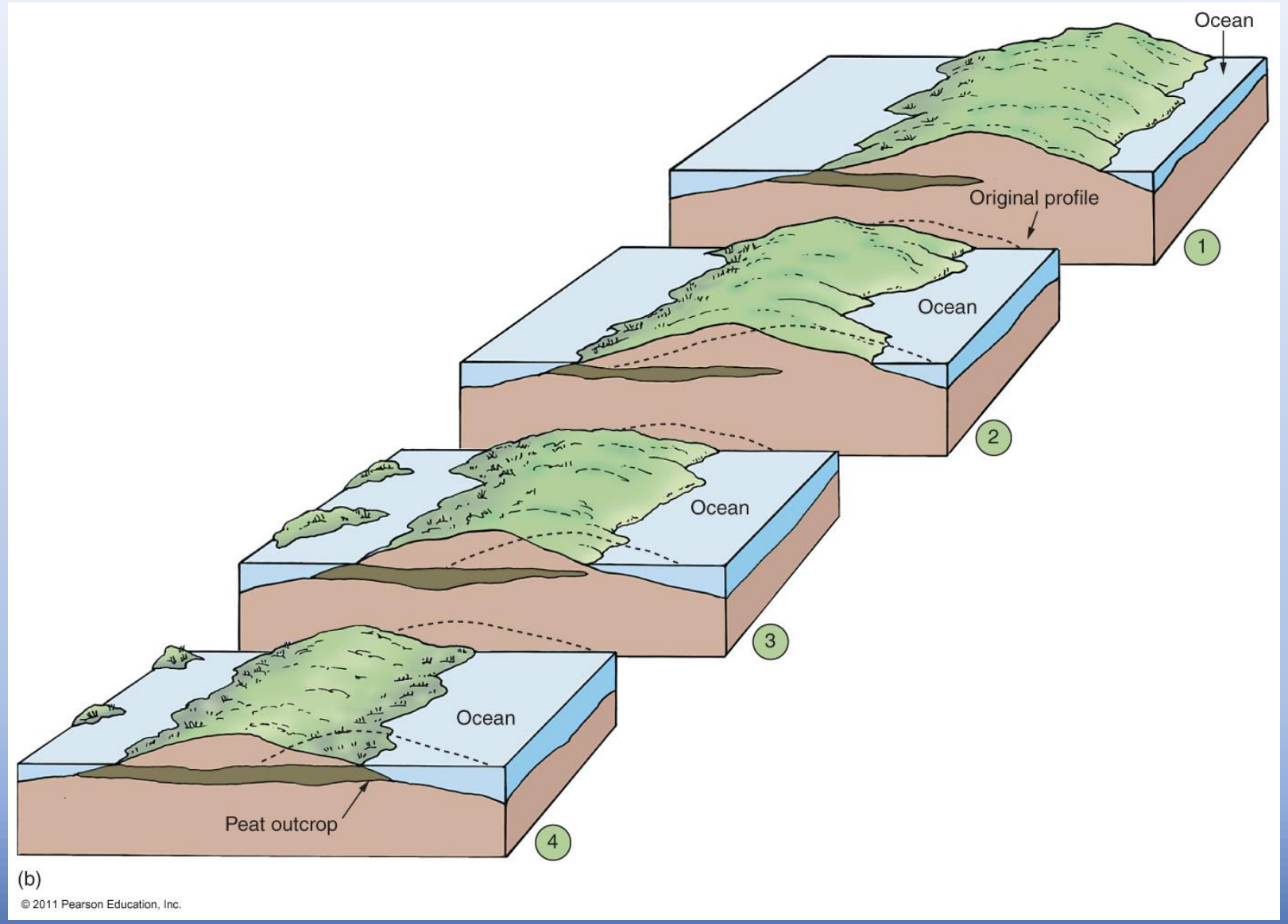
Barrier Island

- Ocean Beach – closest part of the island to the ocean
- Dune – stabilized by grasses; protect lagoon from strong storms
- Barrier flat – grassy area that forms behind dunes



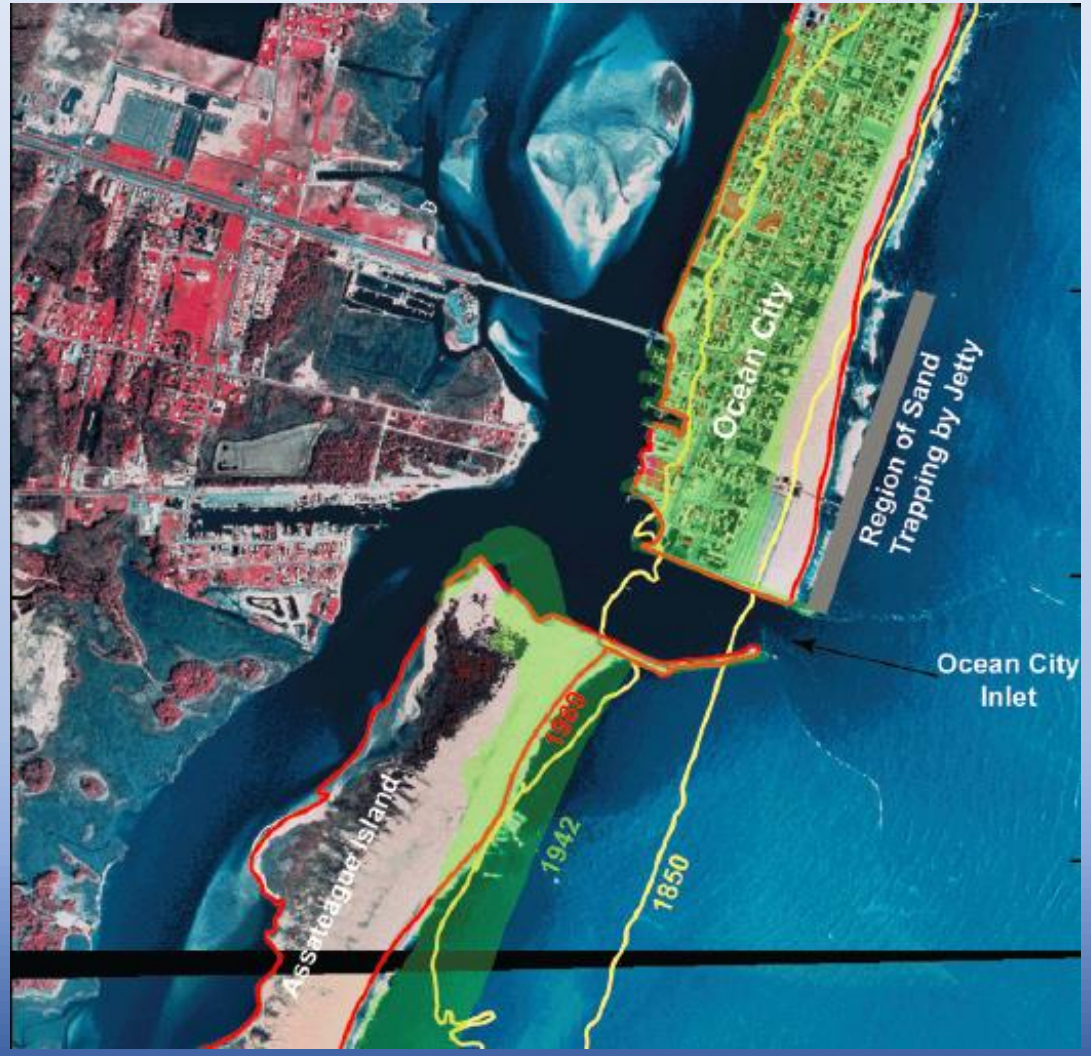
Barrier Islands Transgressive movement (landward)

- Migrate landward over time due to rising sea levels
- Older peat deposits found on ocean beach



Boneyard Beach: Big Talbot Island

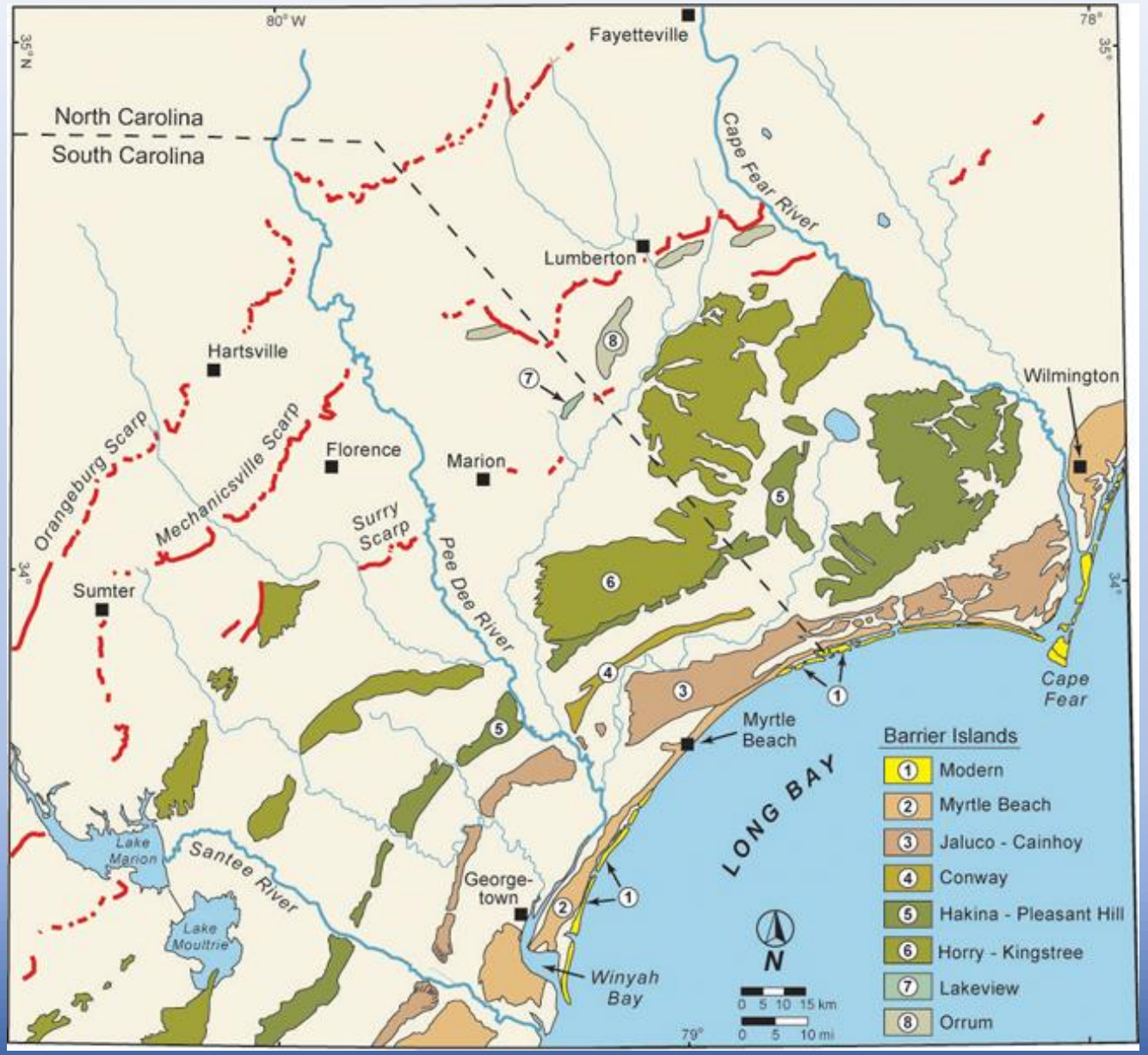
Assateauege Island, Maryland/Virginia

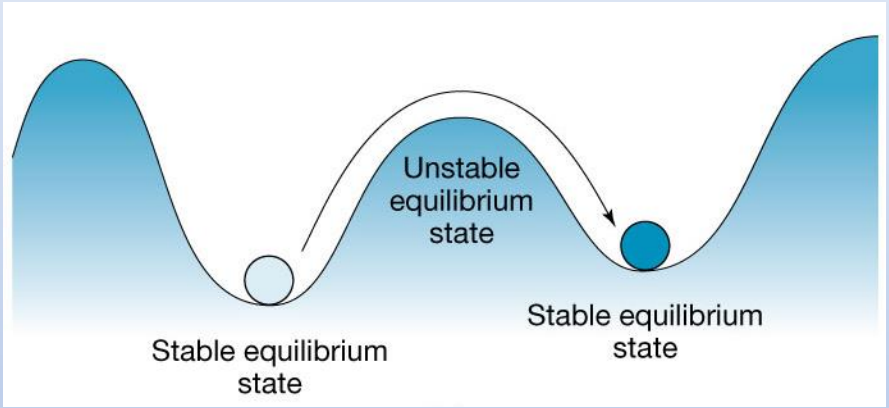


The Assateague Island National Seashore from the Ocean City Inlet southward to the site of the the former Ocean Beach community development, now a campground. From Google Earth

(Source: USGS)

Barrier islands can move Seaward as well





(Source: USGS)

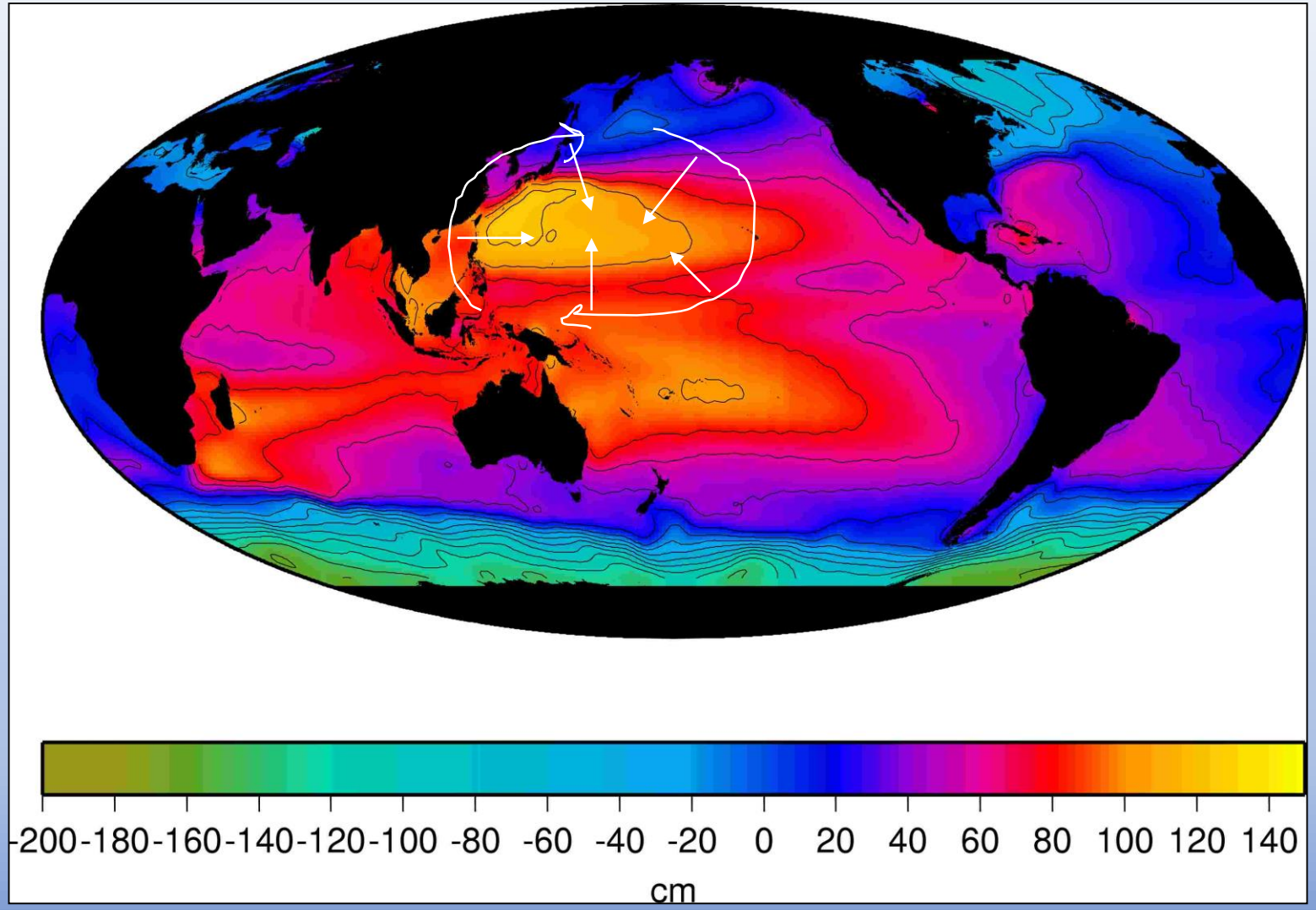
What controls Regressions (oceanward) and Transgressions (seaward) changes?

- Sea level
- Sediment budget

Sea Level: Who's askin'?

- For Cartographers: Mean level of the ocean between the mean High and the mean low tides
- Where are you measuring?? Local datums are often established. This means sea level baselines are not necessarily the same everywhere.
- Your datum matters! Local? National? Global?
- MSS Mean Sea Surface (Global) Points around the world are higher and lower than this average.

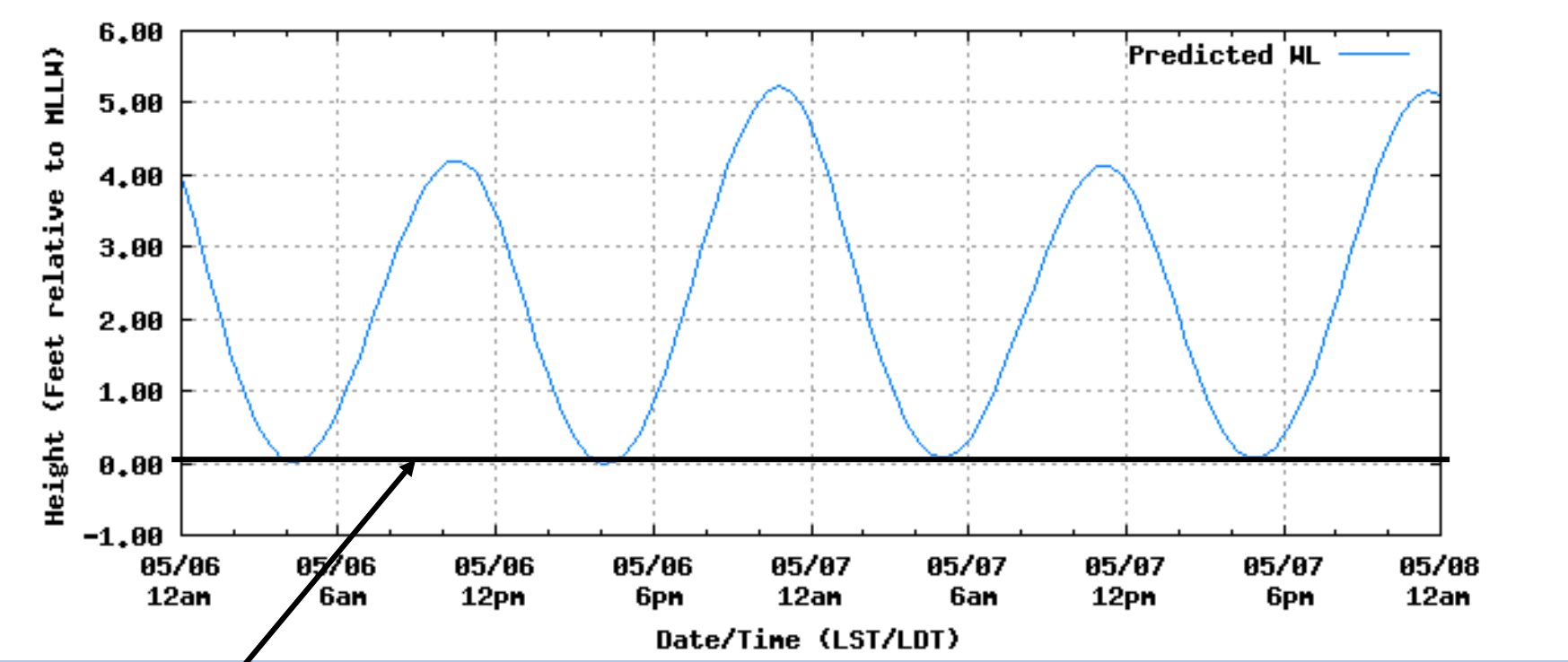
Sea Level: Not so Level: Steric Height



Steric height is overprinted on the Global sea level average.

(Source: World Ocean Atlas 2010)

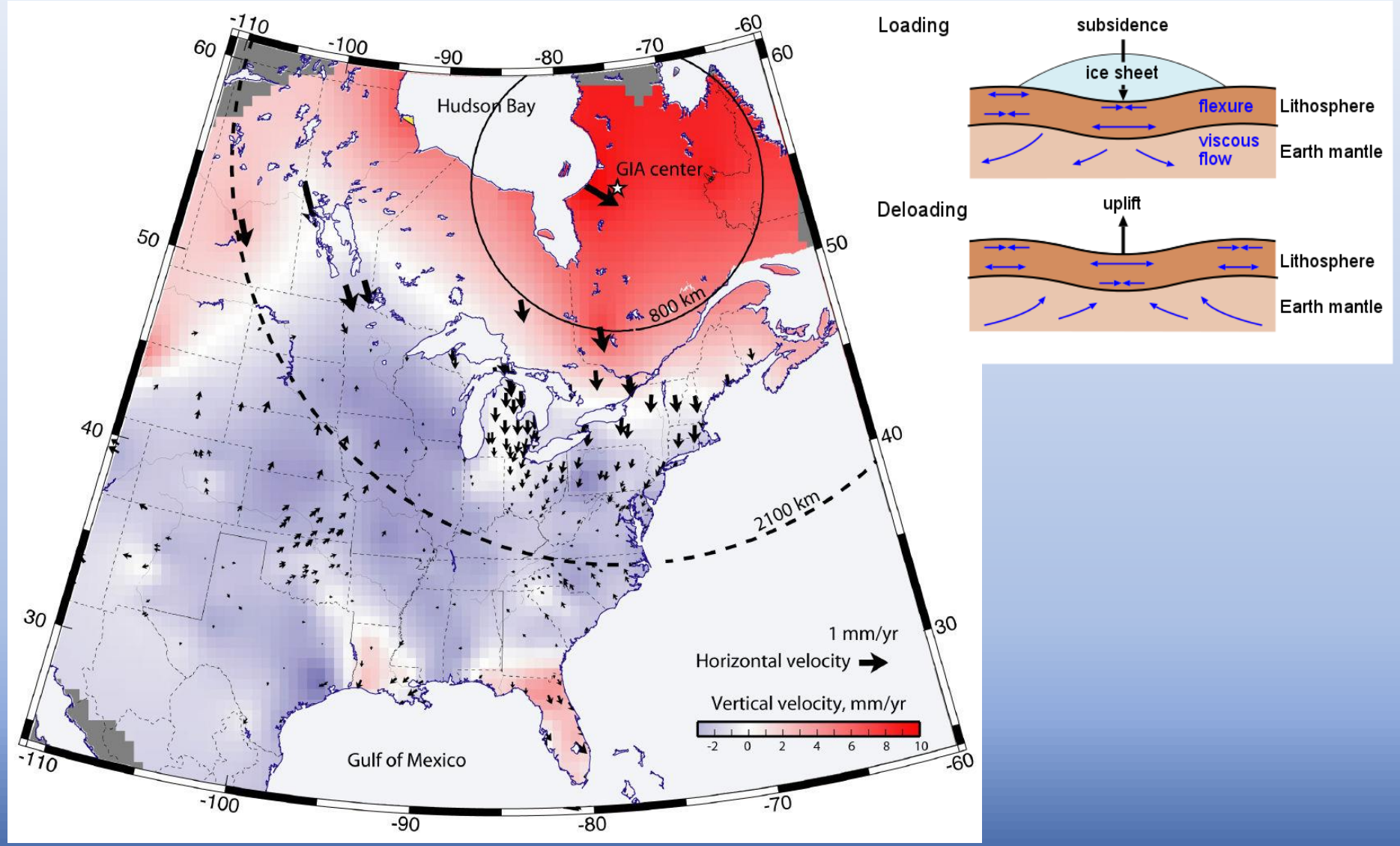
Sea Level: Not so Level: Tides



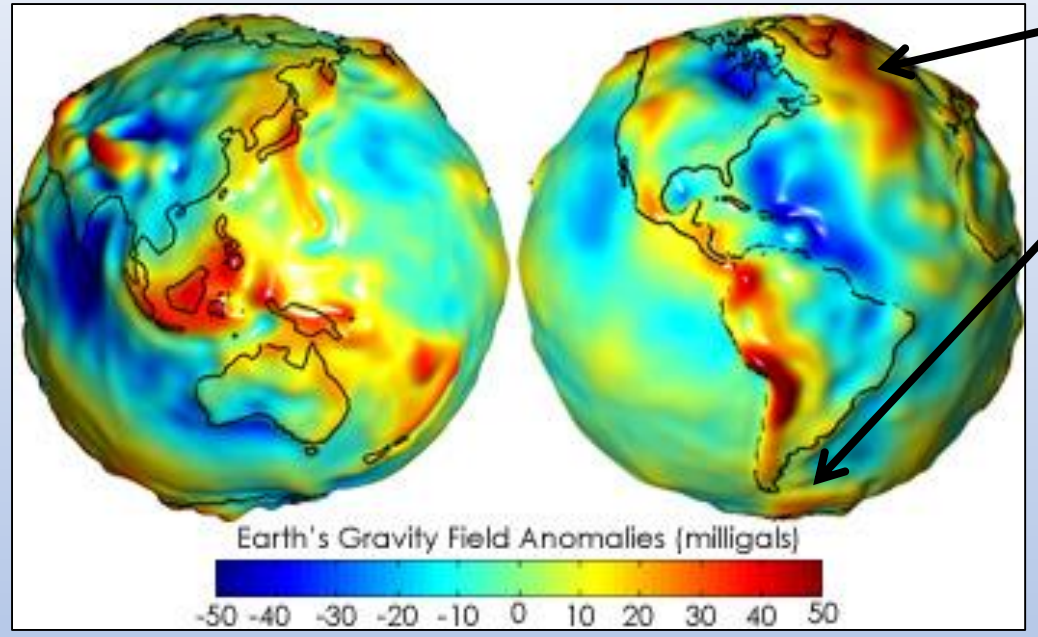
Mean Low Low Water = Average lowest tide annually is essential sea level in tide Plots.

Source: (NOAA)

Glacial Rebound

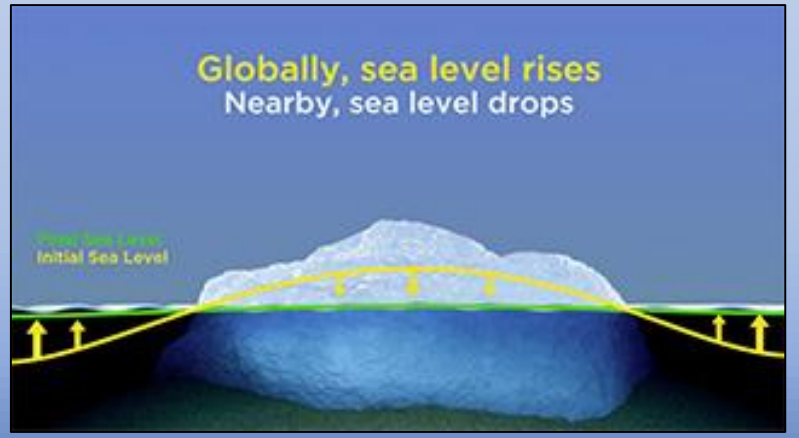


Gravity

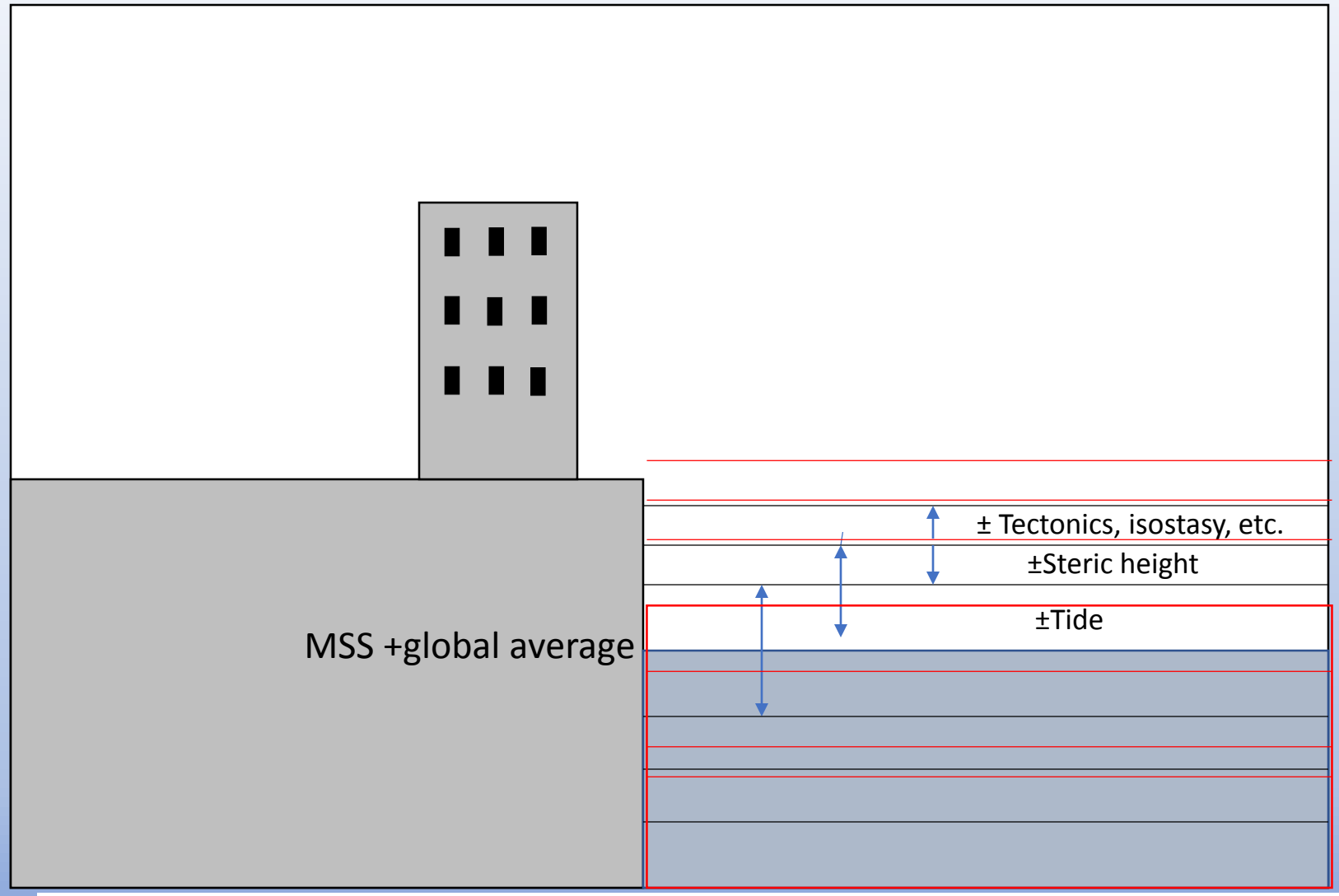


Areas of Higher gravity attract the ocean water Raising sea levels

In these two cases: Greenland and Antarctica the large Ice masses raise sea level near them as much as 1 meter

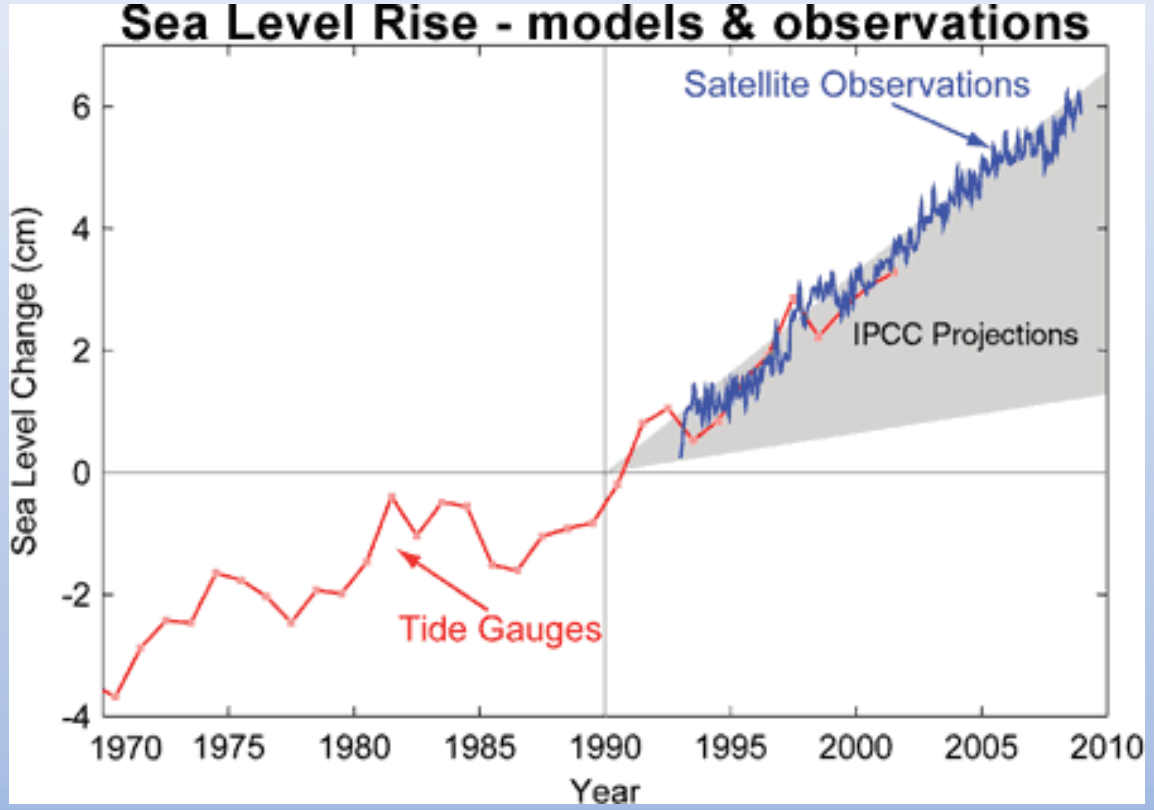


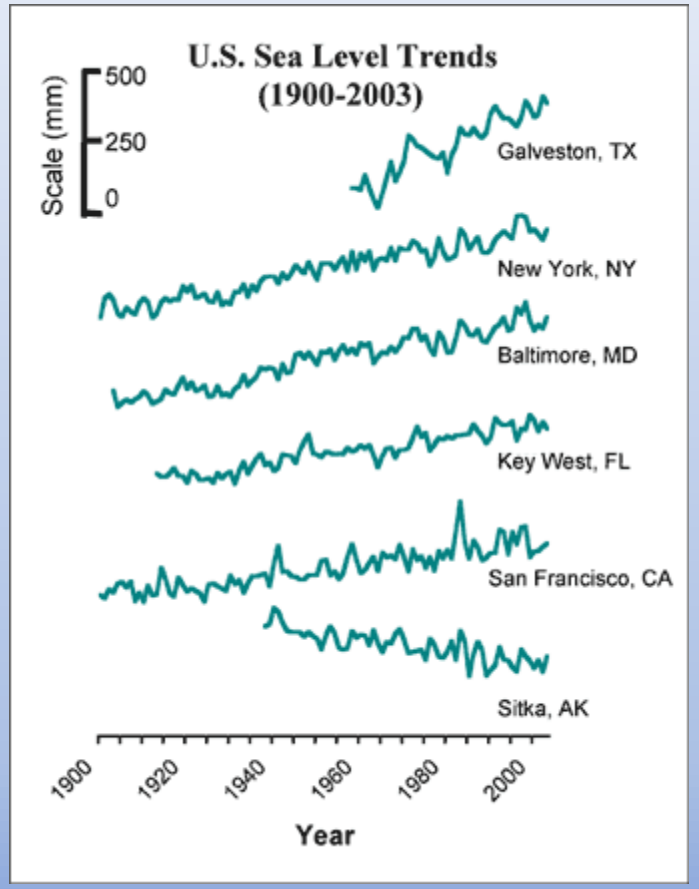
To Sum Up!



Your local Sea level rise be influenced by all of these components. Some are time variable (tide), some are long term (geologic), and some will change with the climate (steric height, gravity, glacial ice changes)

Global levels rising… But not the same everywhere….. And some unique places falling

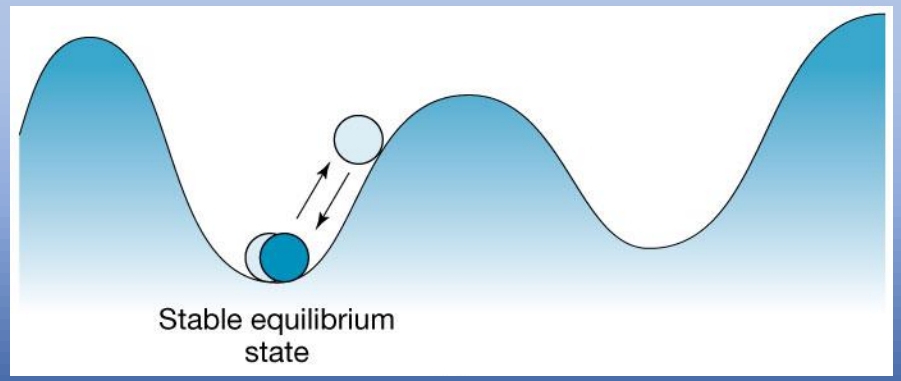


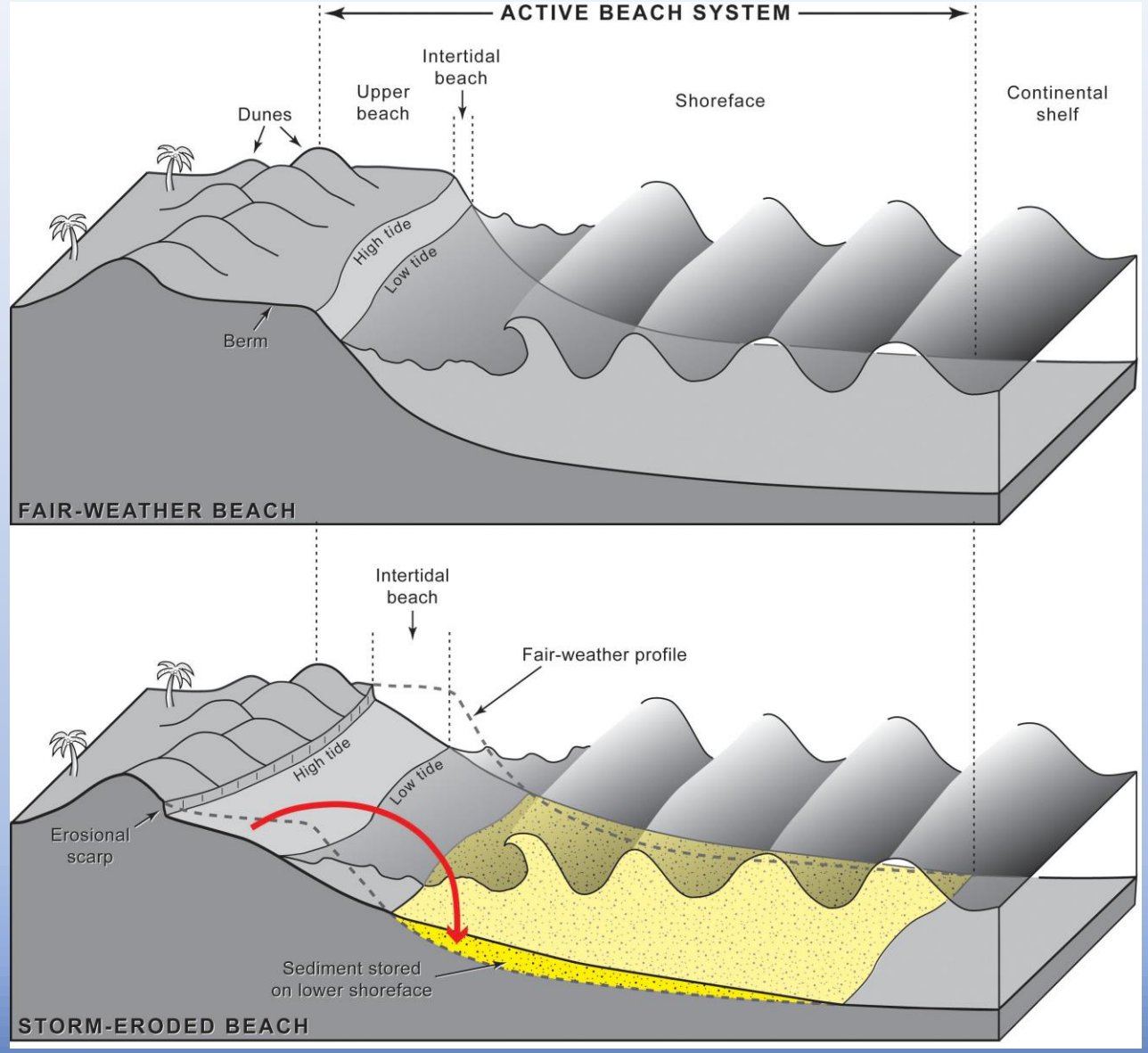


Florida Coastal Beach Systems

Typically Sand dominant

- Summer: Sand stored in the berm/dune system
- Winter: Sand eroded to bars off the shoreline
- Restored during summer back to beach face
- Winter: Erosive
- Summer: Depositional



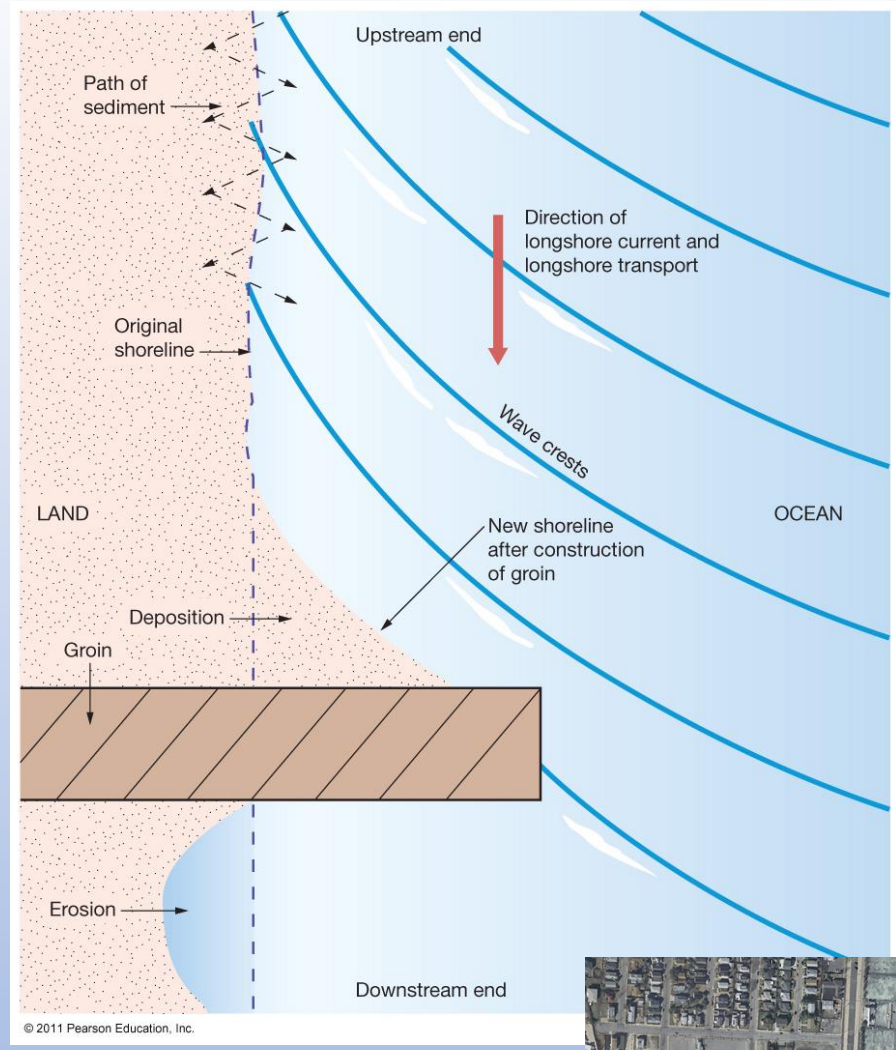


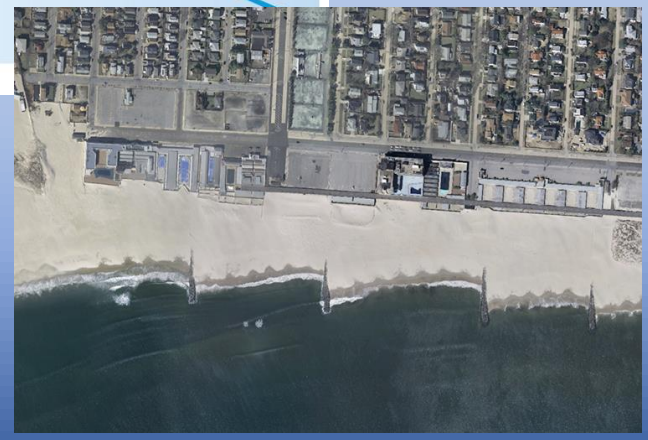
What to do? Possibility 1 Hard Stabilization

- Four major types of stabilization structures:
  1. Groins and groin fields
  2. Jetties
  3. Breakwaters
  4. Seawalls

Groins and Groin Fields

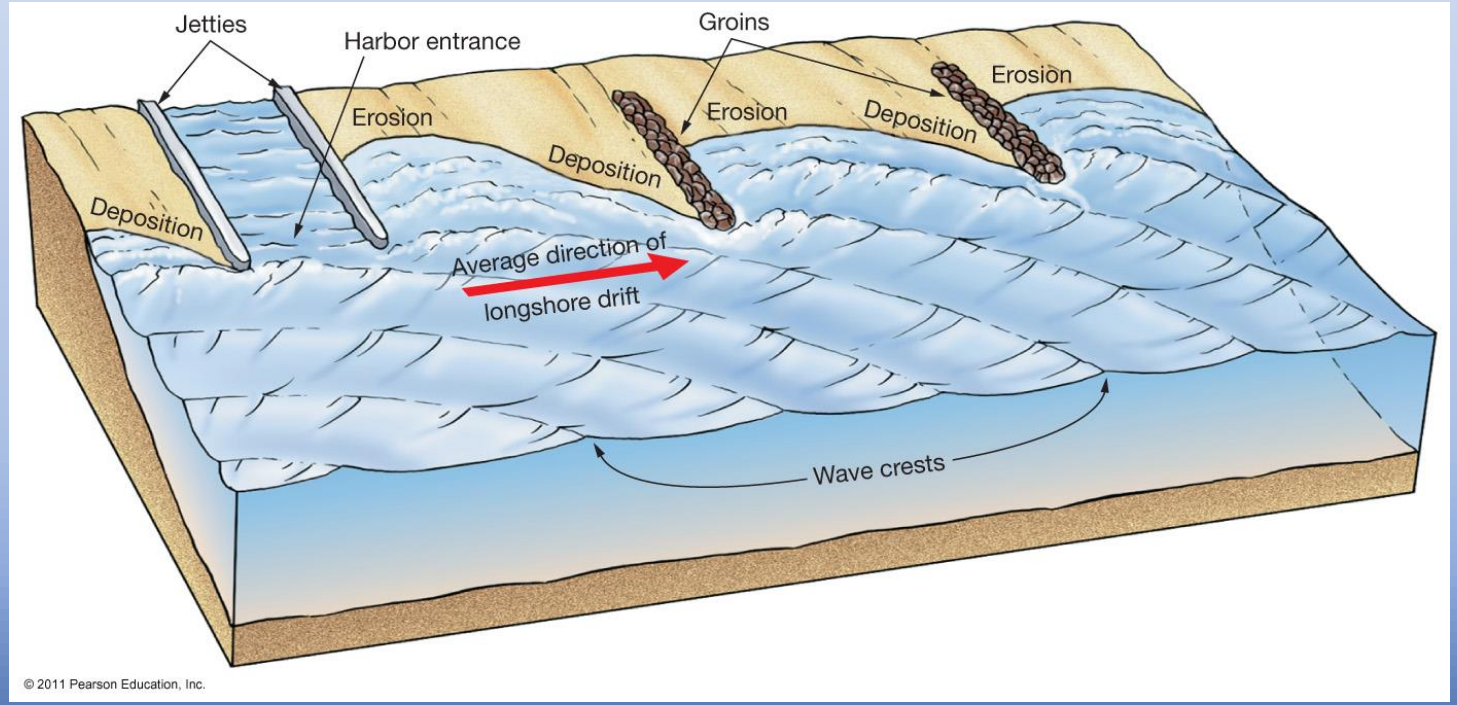
- Built perpendicular to the beach
  - Often made of rip rap, or large blocky material
- Traps sand upcoast, which can cause erosion downstream of the longshore current
- May necessitate a groin field, or a series of groins built along a beach





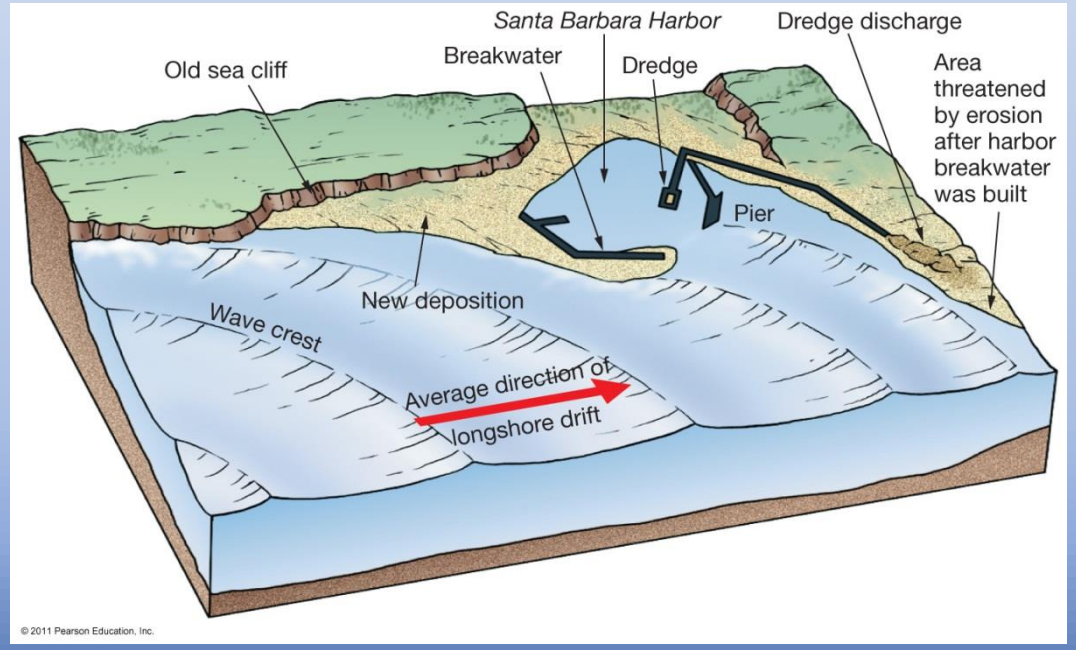
Jetties

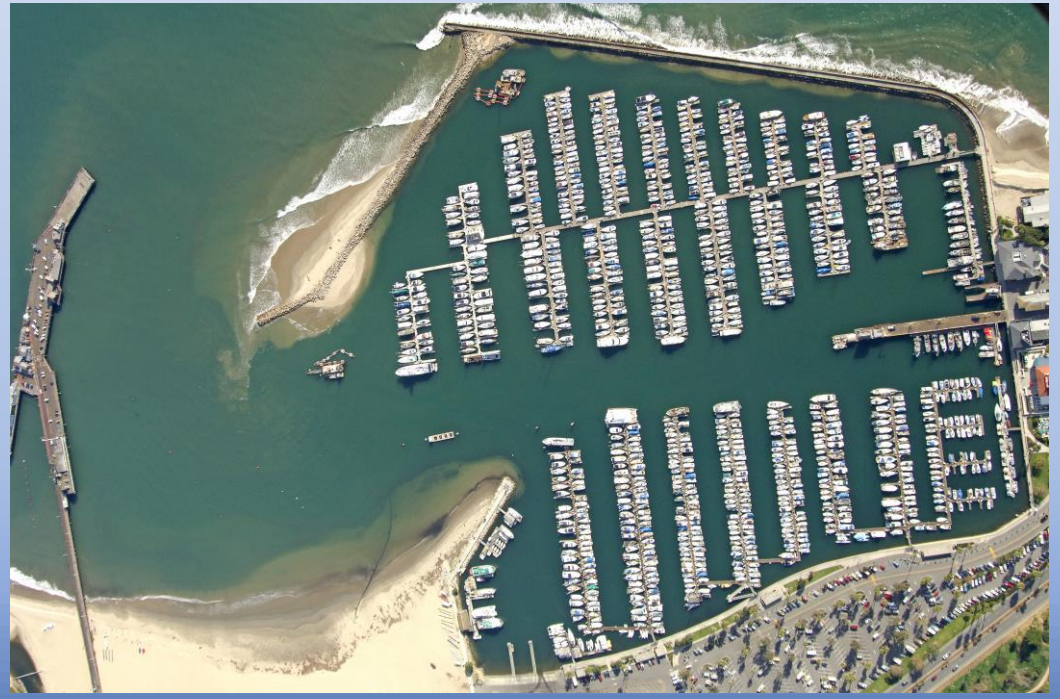
- Built perpendicular to shore
- Built in pairs
- Built to protect harbor entrances



Breakwaters

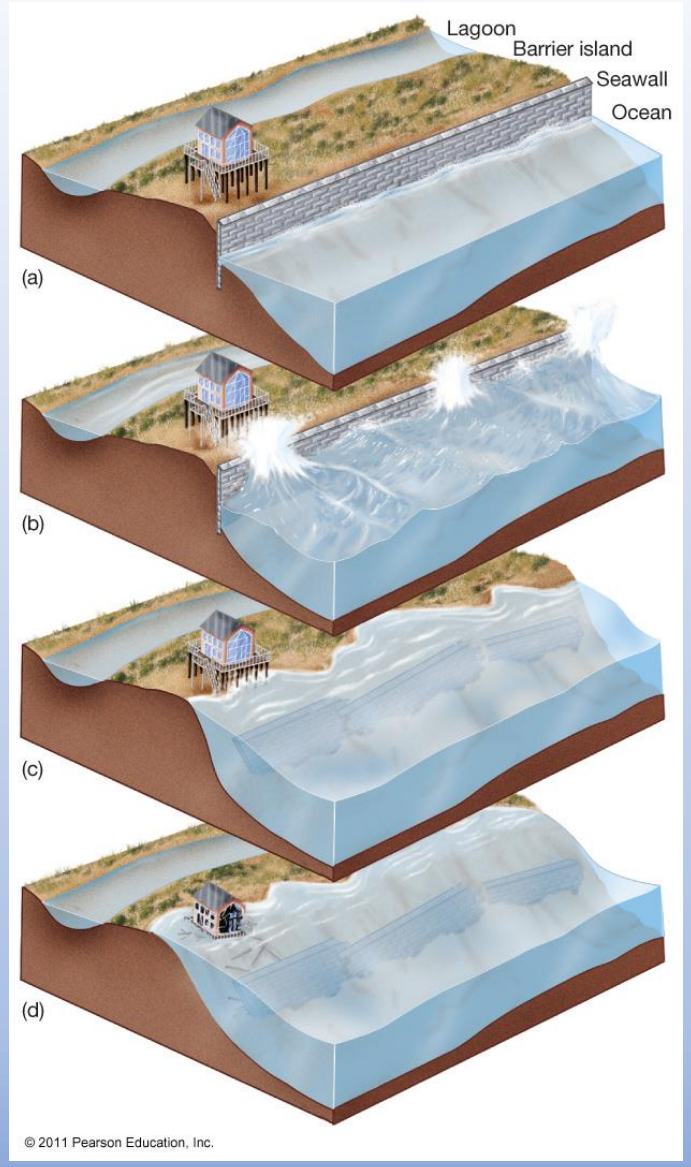
- Built parallel to a shoreline
- Designed to protect harbors from waves
- Can cause excessive erosion, requiring dredging to keep area stable

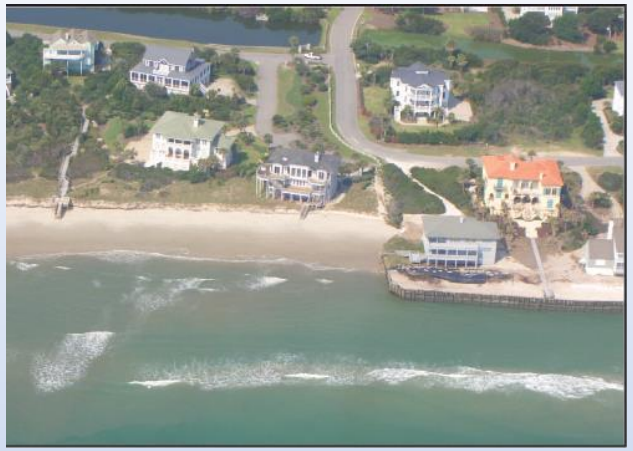




Seawalls

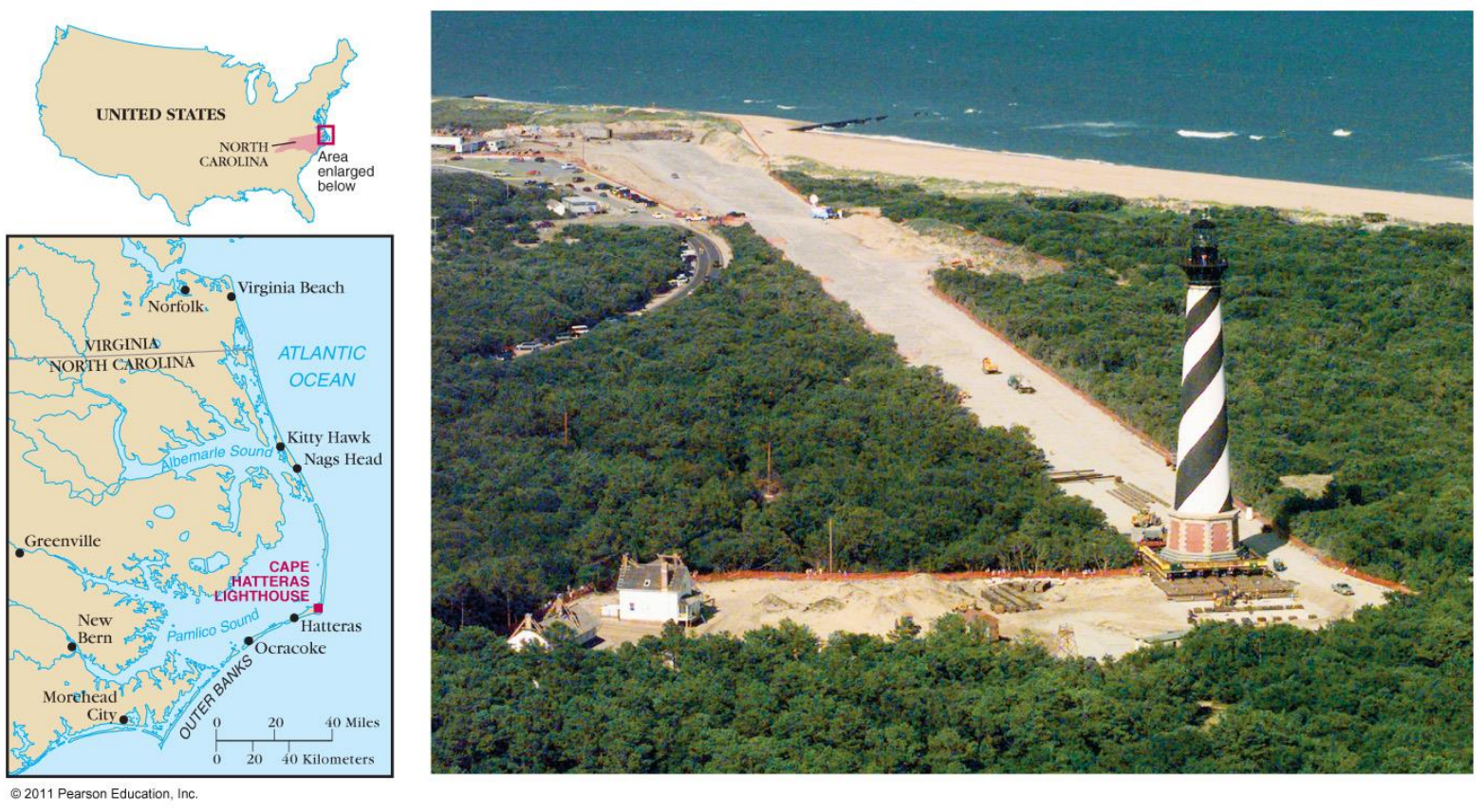
- Designed to armor coastline and protect human developments
- One large storm can remove beach
- Wave activity eventually undermines seawall structure; need continual repair or will collapse
- Can be problematic and interfere with longshore transport.
- All hard structures can Interfere with natural processes like nesting (Birds and Sea turtles)





Possibility 2 Alternatives to hard stabilization

- Relocation
  - Move structures rather than protect them in areas of erosion



Take Heart: You could live in California……and Erosional coastlines……there is no “depositional summer”