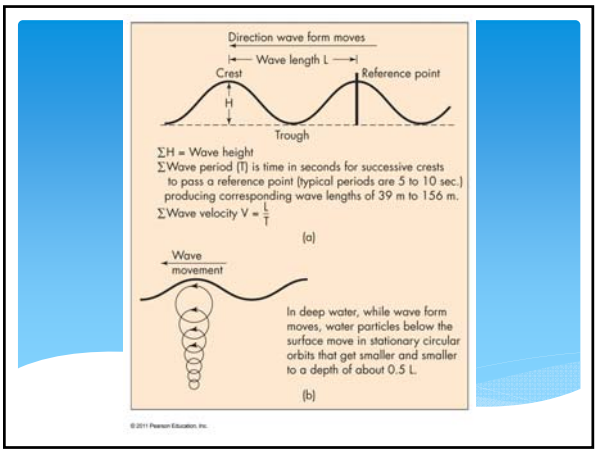
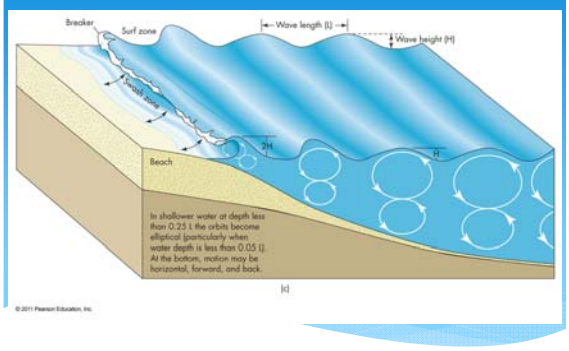
Environmental Geology
Chapter 10
Coastal Hazards: Coastal Erosion and Hurricanes

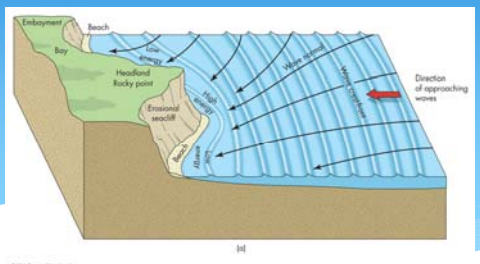
Fall 2015





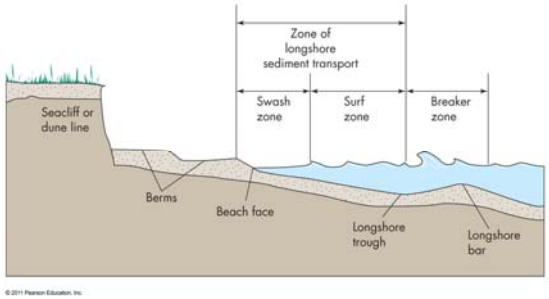
Wave Energy: $E = 1/8\ \rho g H^2$

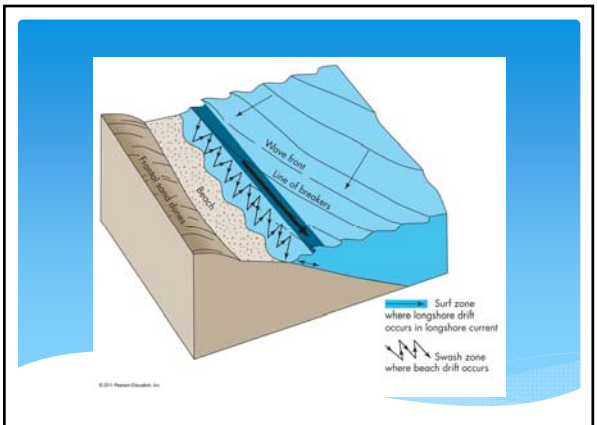
where $\rho = 10^3\ kg/m^3$
$g = 9.8\ m/s^2$
H = wave height (m)

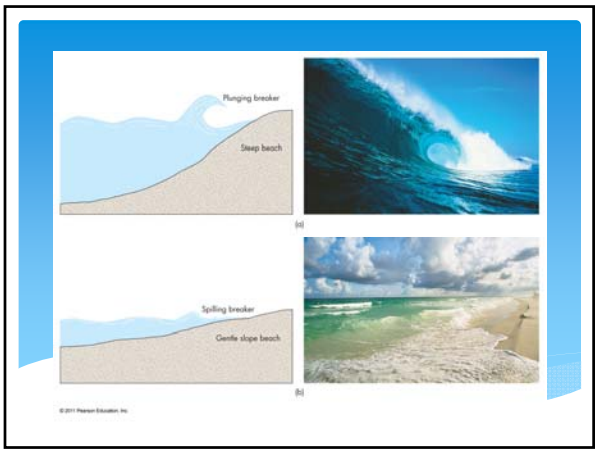


Waves converge through refraction, concentrating energy to headlands.

"A Beach is a landform consisting of loose material, such as sand and gravel, that has accumulated by wave action at the shoreline."

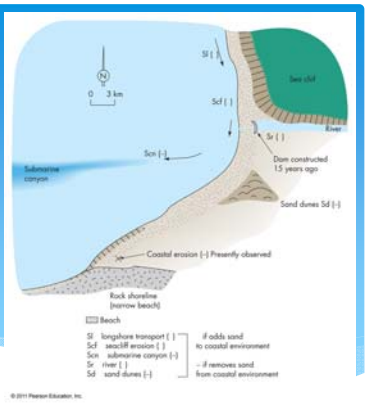


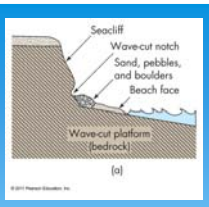




The beach budget is controlled by the inputs and outflows of material to a beach. Beaches build if the beach budget is positive; they erode if the budget is negative.

Changes to the budget can happen over time, allowing for changes in the overall budget. Sea level rise and a warming ocean lead to greater erosion.



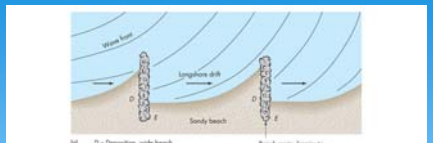


Erosion rates vary from <6 in./year to >2 m/year.

Coastal Hazards and Engineering Structures

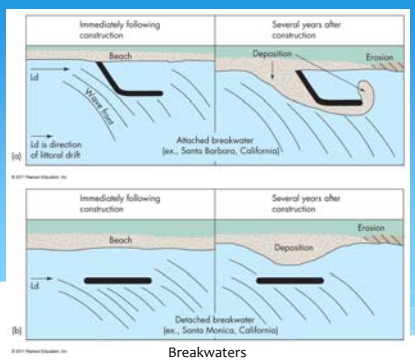
Seawalls

Coastal Hazards and Engineering Structures



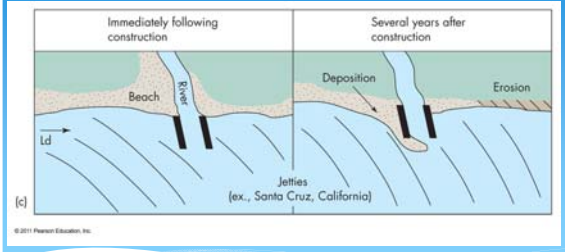
Groins

Coastal Hazards and Engineering Structures



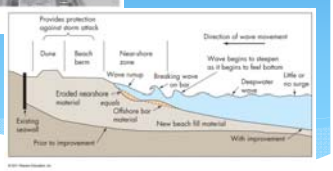
Breakwaters

Coastal Hazards and Engineering Structures



Jetties

Coastal Hazards and Soft Stabilization

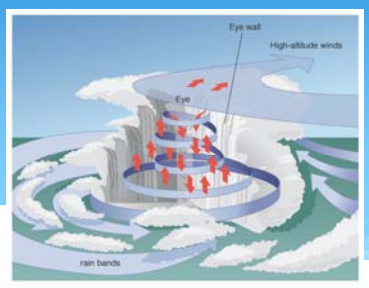


Beach Nourishment

Ocean City, Maryland
Jetties create erosion down-drift.

A hurricane is a tropical cyclone characterized by circulating winds over 100 km/hr generated over an area about 160 km in diameter.

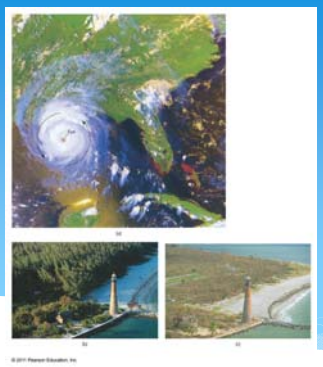
Hurricanes begin as tropical disturbances that under the right conditions will gain energy from evaporating warm water (latent heat). If the wind speeds increase to at least 39 mph the system becomes a named tropical storm. Tropical cyclones with winds over 73 mph are hurricanes.



Hurricane Intensity
The Saffir-Simpson Scale

Hurricane Hazard for the U. S.

Hurricane Andrew



2005 Hurricanes

New Orleans and Hurricane Katrina

New Orleans and Hurricane Katrina

Why was Katrina so bad?

- There was no fall back flood protection (system had no redundancy).
- Katrina exceeded the design criteria of the structures.
- Regional subsidence was greater than appreciated; flood protection not adjusted to account for subsidence.
- Flood control plan not adjusted to new realities.
- Greatest flooding occurred in certain areas – led to more deaths amongst poor and elderly.
- Loss of protection of coastal marshes due to human interference with the natural depositional systems.

Parts of the system have been repaired and improved since 2005.

Adjustments to Coastal Hazards

Coastal Hazards can be adjusted to via

1. Stabilization (hard or soft); $$$ and efficacy is limited
2. Land use changes – better approach but difficult to implement; E-zones or erosion hazard zones
3. Insurance – becoming more difficult to acquire in coastal areas