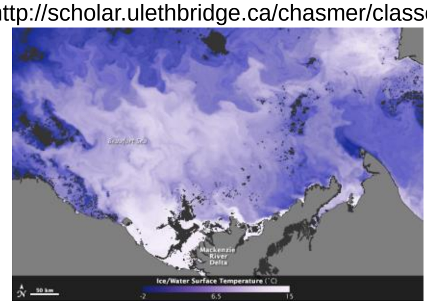
Geog 1000 - Lecture 22

Oceans and Coastal Processes

http://scholar.ulethbridge.ca/chasmer/classes/

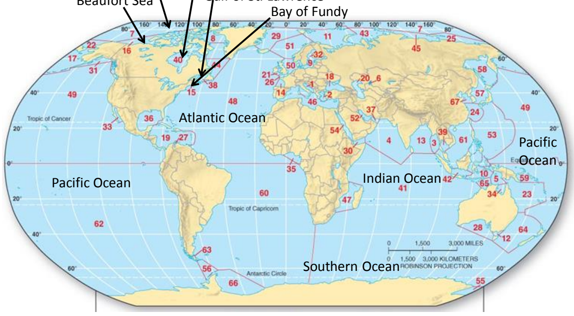


Today's Lecture (Pgs 377 – 386)

1. Ocean composition and structure
2. Components of coastal systems
3. Describing the coastal environment
4. Coastal processes and actions

5. Natural disasters: Flooding of New Orleans

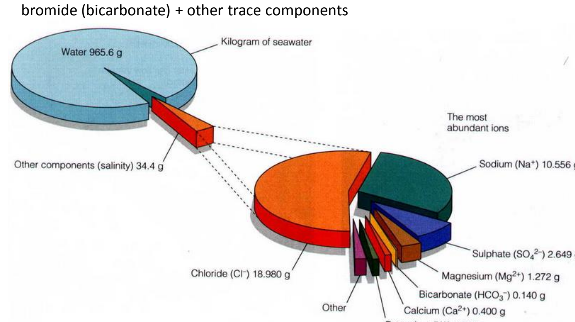
Major Salt Water Oceans, Seas, Features



Chemical Composition of Oceans and Seas

Ocean water is a solution of dissolved solids (solutes) → *Ocean salinity*

Saline components: chloride; sodium; sulphate, magnesium, calcium, potassium, bromide (bicarbonate) + other trace components

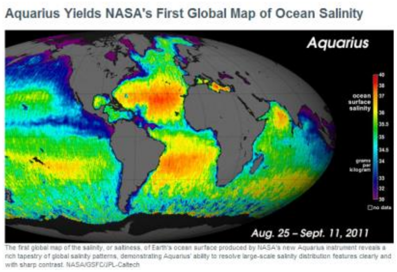


Ocean Salinity

Salinity → solids by volume in parts per thousand (‰)

Average salinity (Brine) = 35‰, varies between 30 – 40‰ (see below, text says 34-37‰). *Brackish water* < 35‰ salt.

Why do we see spatial and/or temporal variations in salinity?



Ocean Acidification

Human emission of carbon dioxide = 45 billion tons per year. Ocean absorbs 50%

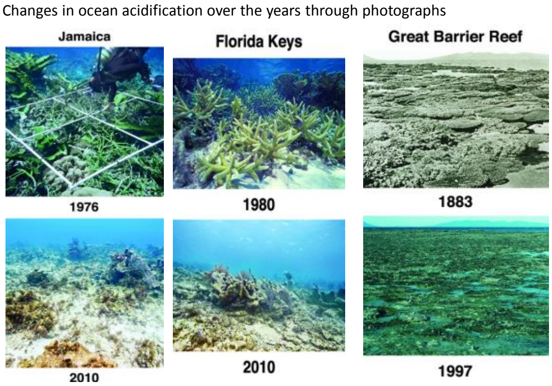
Absorption of carbon dioxide = Reduced ocean surface pH levels

→ *formation of carbonic acid, 30% increase in acidity*

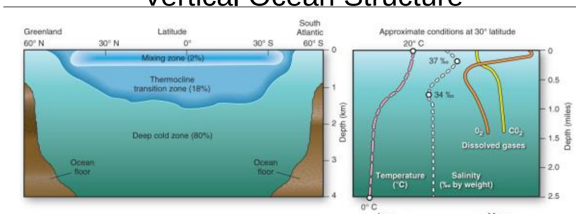
→ *Organisms no longer able to build shells*

Ocean Acidification

Changes in ocean acidification over the years through photographs



Vertical Ocean Structure



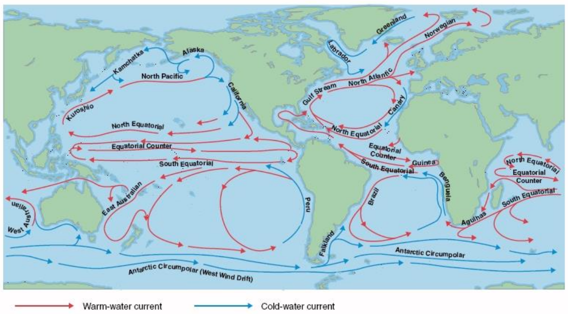
Mixing zone → Warmed by sun, moved by wind

Thermocline transition zone → Decreasing temperatures, little motion from wind, convection

Deep cold zone → uniform salinity, unfrozen at 0°C, would freeze at -2°C due to high pressure.

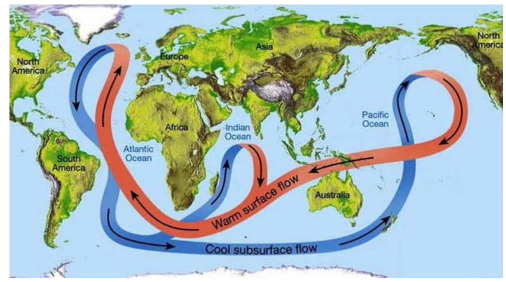
Coldest water at the bottom.

Horizontal Ocean Structure: Ocean Currents



- → Determined by winds and temperature.
- → Mainly driven by circulation around subtropical High pressure cells. Clockwise in NH and counterclockwise in SH.

Thermohaline Circulation



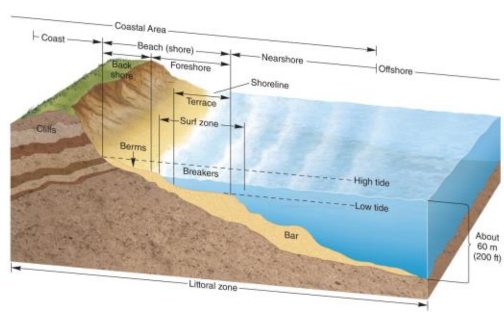
- → Driven mainly by salinity and temperature
- → Redistribution of heat.

Forces Influencing Coastal Environments

Solar Energy → winds, weather, climate → Tides Waves Currents → Erosion Transportation Deposition → Human Activity → Coastal landforms, geomorphology

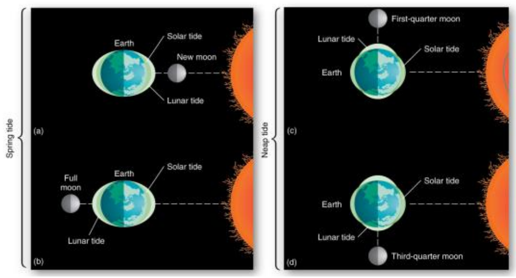
The Littoral Zone

The coastal environment: Extends from highest onshore waterline to point where water is too deep for waves to move sediments



Coastal Processes and Actions

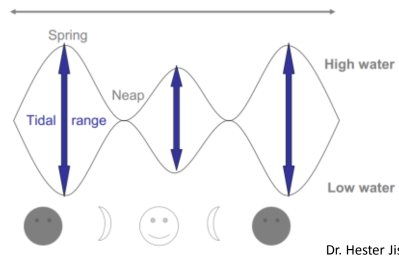
Tidal Systems:
→ Occur twice daily, influence erosion
→ Created by gravitational pull of the sun and moon (moon has greater influence).
→ Pull of moon = bulging of ocean on one side, less bulge on other side
→ Rotation of Earth = two high *(flood)* tides, and two low (*ebb*) tides



Coastal Processes and Actions

Spring tide (leap up) → Increased tidal range 2x per month
→ Sun and moon along same plane = higher high and lower low water.

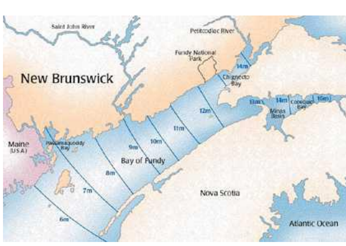
Neap tide → Decreased tidal range: 2x per month
→ Occurs during first and last quarter moons
→ Sun and Moon at right angles to each other relative to Earth



Dr. Hester Jiskoot

Bay of Fundy, Nova Scotia: Largest Tides

Variations in tides a result of **Area, Depth, Topography** of the ocean basin; latitude; shape of the shoreline.
→ Vary from a few mm to 15 m

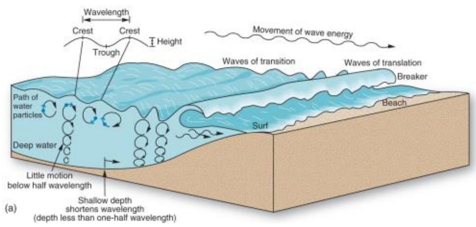


Bay of Fundy, Nova Scotia: Largest Tides

Coastal Processes and Actions

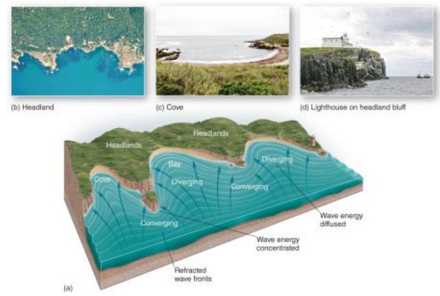
Wave Action → Friction between wind and ocean surface

Can you see two wave trains?



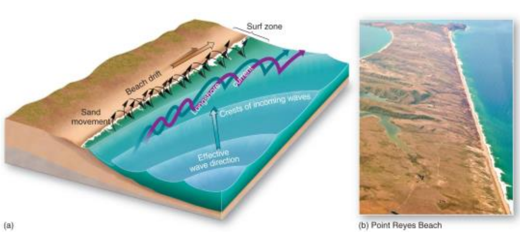
Coastal Processes and Actions

Wave Refraction → Redistribution of wave energy: Some parts of the coastline erode, others do not (surface material).
→ Eventual straightening of the coastline.
→ Energy is dissipated in coves.



Coastal Processes and Actions

Littoral (Longshore) drift → Current formed from wave collision forming deeper water zone near shore.
→ Transports sand, gravel



Hurricane Katrina, Coast of New Orleans

About Hurricane Katrina:

One of the top 5 deadliest hurricanes in US history.

Total Fatalities: 1,833
Highest Wind Speeds: 280 km/hr
Lowest Pressure: 902 mb
Flooding up to 4 m depth

August 23, 2005 to August 30, 2005

Made landfall in Louisiana on August 29, 2005

Category 5 hurricane.

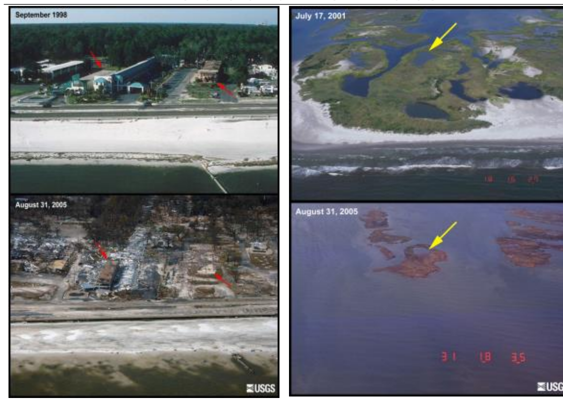
Louisiana: A Vulnerable Coast

Between 1932 and 2000, 4,900 km2 of coastal islands were lost.

A further 562 km2 were lost during Hurricanes Katrina and Rita

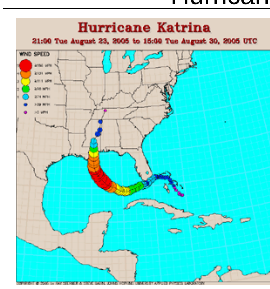
Losses correlate with oil and gas production on coast → subsidence and loss of wetlands.

Before and After Photos



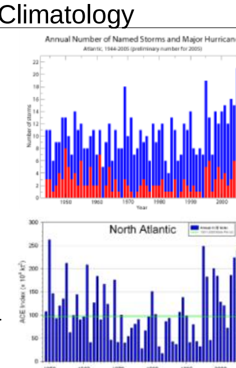
Before and After Photos

Hurricane Climatology



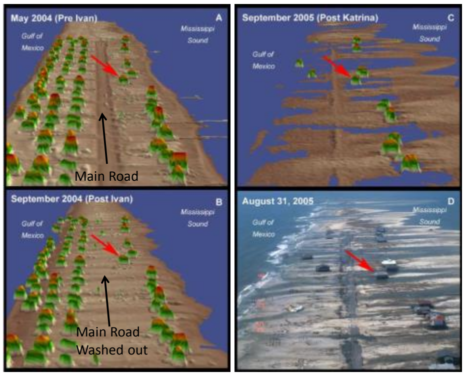
Increase in numbers of hurricanes since 1995.
→ 13 storms since 1995
→ 8 storms since 1970

Due to warm sea surface temperatures since 1970s.

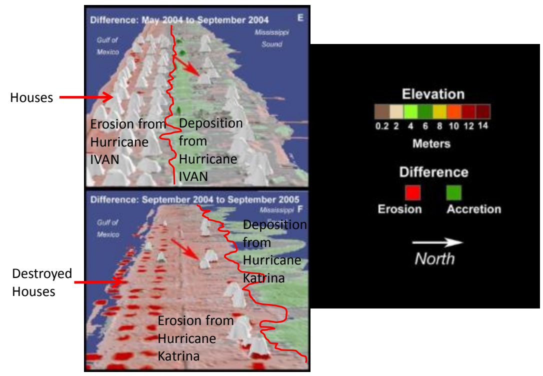


http://www.ncdc.noaa.gov/extremeevents/images/2005/atlantic-2005-ace.png

Volumetric Change on Dauphin Island



Volumetric Change on Dauphin Island



Volumetric Change on Dauphin Island