April 7, 2015
GEOL 1010-002 (Notes)

Lecture 14—Coastlines and Oceans

Why Should We Care?

- About 53% (>3.5 billion) of the world population lives within 120 miles of a coastline

Coasts

- **Remember**—Still on continental crust
- Several forces acting on these environments
    - Rapidly changing processes

Coastal Processes

- **Tides**—Rise and drops in sea levels (high vs. low tides)
- **Tidal Flats**—Sometimes above water, sometimes not
    - In between points of tides
    - Exposed during low tides

Tides

- **High Tide**—Sides facing towards and away from moon
- **Low Tide**—The in-between sides
- **Spring Tides**—Higher tides
    - Full Moon
    - New Moon
- **Neap Tide**—Weak, lower tides
    - 1st and 3rd quarter moons (perpendicular angle with moon)

High Tide and Low Tide Occur Daily while Spring Tide and Neap Tide Occur Seasonally

Tide Heights

- Hawaii has a tidal range of 1-2 feet
- Bay of Fundy has a tidal range of ca. 40 feet
- **Low Tide Height**=Stretch of coastline open
- **High Tide Height**=Stretch of coastline sheltered
- How well the coast is connected to the ocean determines the tide

Coastal Processes

- **Waves**—Vary with a lot of factors
- Size increases with increase in wind speed, longer duration, and greater distance

Waves

- **Wavelength**-Distance between same point on any two adjacent waves (between 2 crests and 2 troughs)
- Waves get higher, slower, and closer together coming towards the shore
    - Waves change depending on water depth
- **Wave Refraction**—Change in a wave's direction (hits shoreline at a different direction)
    - Dependent on water depth

Coastal Processes

- **Longshore Current**—Flows parallel to coastline (purple line on Slide 14)
- **Longshore Drift**—Sediment transport parallel to coastline
- **Key**—Delicate balance of processes
    - Coastal areas **VERY COMPLICATED**→Dynamic
        - Change one variable can have a ripple effect on other variables (Slide 15)
        - Why construction in coastal areas is tough

Shoreline Features

- Shoreline features depend on:
    - Tectonics
    - Rock type
    - Sea level fluctuations
    - Tidal and storm size/strength

Types of Coastlines

- **Emergent Coastline**—The areas being pushed above sea level

Emergent Coastlines

- **Stacks**—Small, steep-sided islands
    - Often represent tops of hills and ridges peaking above water (due to being uplifted)
- **Terraces**—Broad, flat areas separated by slopes
    - Stair-step pattern
    - Represent where the beach used to be located

Types of Coastlines

- **Submergent Coastline**—Sinking, lot of subsidence occurring
    - Lots of flooding (Area sinking below sea level)
    - Massive amounts of sediment deposition

Submergent Coastlines

- Long, wide beaches and coastal plains
    - **Ex.** South Carolina
- **Spit**—Long, narrow bodies of sand still attached to mainland (coast), but building out into the water

- **Barrier Islands**—Look like spits, but not connected to mainland anymore→Dynamic environment
    - Isolated island→Tough place to live
    - Position of island very transitory due to deposits of sediment (location changed)
        - Ground naturally moving (not good for stable structures)

Coastal Erosion

- Can occur along Emergent and Submergent Coasts
- Can become a natural hazard
    - Building things too close to coastline **(Building Problem)**

Barriers

- Structure meant to protect coast
- Protect the shore in one of two ways
    - Stop sand movement
    - Reduce wave energy
- Several types of barriers used

Barrier Types

- **Seawalls**—**Built** parallel to coastline
    - Block waves from hitting shore, thus stopping erosion
        - **Drawbacks**
            - Expensive to build (over $1,000 per foot)
            - Not a one time cost→Repair wall over time
            - Not a lot of areas build seawalls due to adverse effects on tourism
- **Groins**—Built perpendicular to coastline
    - Not good for blocking waves
    - Goal is to disrupt longshore current, and as a result, stop longshore drift
        - When water slows down, it drops a lot of sediment
        - Leads to buildup of sediment on beach
        - **Drawbacks**
            - Expensive
            - While protecting one area of coast, it leaves another area of coast prone to very rapid erosion
                - **Solution**—Build a second groin (or series of groins)

Non-Barrier Approach

- **Beach (Re)nourishment**—If you lose sediment to erosion, just buy more sediment or dig up sediment form ocean to put on coast

Beach Nourishment

- **Case Study:** Miami vs. NJ
    - **1950s**—Miami had no beach due to erosion