Coastal Oceanography

In 1990, 50% of the U.S. population lived within 75 km of a coast.

By 2010, 75% of the U.S. population will live within 75 km of a coast.

Some Key Concepts in Chapter 11

- Coasts are temporary structures, often subject to rapid change.
- The location of a coast depends on tectonic activity and the level of water in the ocean.
- The shape of a coast is a product of many processes.
- Coasts can be classified as erosional or depositional. There are also biological coasts.
- Human interference in coastal processes seldom increases the long-term stability of a coast.
Shores, Coasts, Beaches, Estuaries

- **Shore** = Where the ocean meets land - Shoreline
- **Coast** = Larger zone affected by the processes at this boundary - Coastal zone
- **Beach** = Zone of loose particles covering part or all of a shore
- **Estuary** = Where fresh & salt water mix - e.g., Puget Sound

It’s all a balancing act...

- Uplift & subsidence
- Erosion & deposition
- Rise & fall of sea level
- Hard rock & soft sediment
- Humans & nature

1. Factors in Sea Level Changes

[Image of a cartoon with sharks and a message about global warming causing sea level rise]

http://ecosystems.wcp.musohio.edu/studentresearch/climatechange02/sealevel/sealevel.htm
Factors in Sea Level Changes

- **Eustatic (worldwide) changes**: (See Fig. 11-2, p. 247)
  - Volume of ocean “container” (seafloor spreading, continental erosion)
  - Amount of water in the oceans (world climate, outgassing)
  - Water temperature (expansion when warmer)

- **Local changes**:
  - Plate tectonics (active vs. passive continental margin)
  - Isostatic adjustments (rocks/sediments, glacial ice)
  - Water pushed onto or pulled away from shore (wind, currents, seiches, storm surges, El Nino/La Nina)

---

**“Ice Age”**

Thousands of years before present

- Sea-level below present (m)
- 120 meters deep
  - Cold climate (last ice age)
- 35 meters high
  - Warm climate
  - Pliocene, 3 million years ago

---

http://www.pog.su.se/sea/07_research_topics/bilderstora/fig.7_14_1_500.htm

http://geochange.er.usgs.gov/pub/sea_level/
Global warming

Tide gauge data, NYC

Oxygen isotopes record changes in sea level

Isostasy & glaciation

20,000 years ago, the ice over Seattle was higher than 5 Space Needles (3,412 feet thick)

Marine terraces (arrows) on a tectonically uplifting coast

See Fig. 11.5c, p. 250; Fig. 11.29, p. 265
2. Erosional Coasts

Wave motion is influenced by water depth and shape of the shoreline

Variables out at sea control wave energy at coast

- Wind velocity
- Wind duration
- Fetch (= area over which the wind blows)

What Causes the Sea Level to Change?

http://www.unep.org/vitalwater/41.htm
**Wave Refraction:**
The bending of waves as they change velocity

1. Waves approaching at an angle
2. Waves approaching parallel to shore

**Erosional Coasts**

- **Headlands eroded**
  - Sea arches
  - Sea stacks
- **Wave-cut cliffs**
  - Sea caves
- **Tectonically active**
  - Example: Pacific coast U.S.
Large-Scale Features of Erosional Coasts

See Fig. 11.5, p. 250

“5-Minute Write”

1. Summarize the main points of today’s lecture.
2. List 3 to 5 questions you have, based on today’s lecture.
3. What did you find most interesting about today’s lecture?
4. How was the lecture relevant to you?