

Changing Sea Levels

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Economics 428 Prompt

1. How are sea levels measured?
2. By how much have sea levels changed over the past hundred years?
3. Has the change in sea levels been the same for all oceans or has the change in levels differed by ocean?

Why do we need accurate Sea Level measurements?

- Determine if the oceans are rising or falling over time
- Measure the height of everything on land accurately
 - Ex. calculating the actual height of Mt. Everest is complicated by sea-level measurement inaccuracies.

Factors that impact Sea Levels

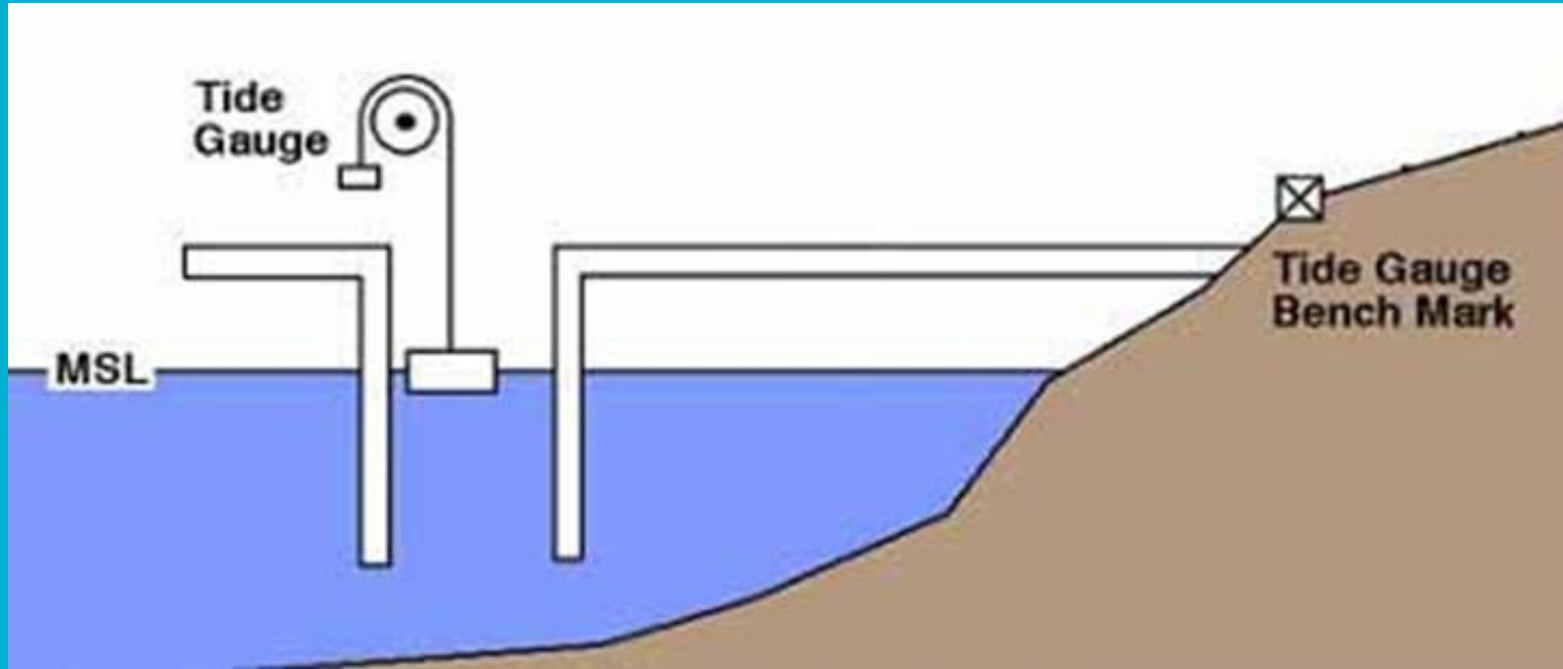
- Tides (Moon)
- Large and Small Waves (Wind, Tide)
- High- and low-pressure areas in the atmosphere
 - changes the surface level of the ocean
- Temp changes in the ocean
 - changes the density and volume of the water
- Rainfall and river water flowing into the ocean

How Sea Levels are measured?

Tide Gauges (Stilling Well): “Large (1 foot [30 cm] or more in diameter), long pipe with a small hole below the waterline. Even though waves are changing the water level outside the gauge constantly, they have little effect inside the gauge. The sea level can be read relatively accurately inside this pipe. If read on a regular basis over a time span of years and then averaged, you can get a measurement of sea level.”

Getting an accurate reading (for example, down to the millimeter level) is extremely difficult. Satellites are now used as well, but they suffer from many of the same problems.

Tide Gauge (Diagram)



How past Sea Levels are estimated?

Statistical synthesis of a global database of regional sea level reconstructions

It used a new statistical framework to combine reconstructions of 1,300 geological sea level changes in 24 locations around the world, along with measurements from 66 "tide gauges"

How much has the Sea Levels changed?

Scientists modeled back 3,000 years and concluded that the rate of increase last century (1900-2000) "was extremely likely faster than during any of the 27 previous centuries."

95% probability that the rate of sea level increase in the 1900s was faster than during any century since at least 800 B.C.

How much has the Sea Levels changed?

Global sea level rose at a rate of 1.4 mm (0.05 inches) a year during the 20th century.

NASA's figures, which put the current rate of sea rise at 3.4 millimeters (0.13 inches) a year, suggest sea level rise is only accelerating.

How have humans impacted Sea Levels?

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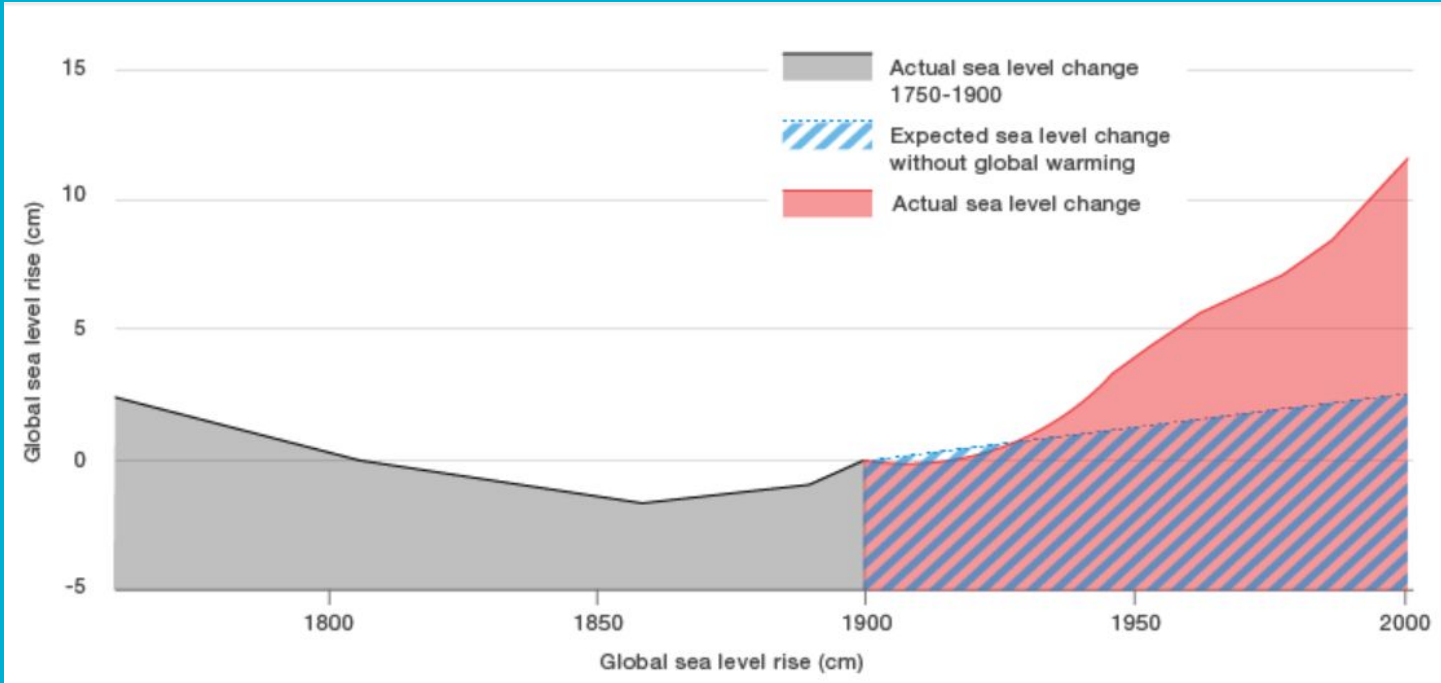
"Significant" and "historic" acceleration in sea level rise began in the 19th century

An assessment report from the U.N's Intergovernmental Panel on Climate Change in 2013 found with 95% certainty that human activity was to blame for at least half of climate change in the last half-century.

Fun Fact

The 20th century "wasn't the only time period when temperature and global sea level changed together" The study found that that the global sea level fell by "a statistically robust" 8 centimeters between 1000 and 1400, a period in which the global temperatures declined by about 0.2°

Global Sea Level Change



Source: U.S.'s Proceedings of the National Academy of Sciences

Where are we heading?

Rising sea levels caused by a 4°C increase in warming from carbon emissions could submerge land that is currently home to up to 760 million people

The top 10 cities with the largest threatened populations were all located in Asia and include Shanghai, Hong Kong, Calcutta, Mumbai, Dhaka, Jakarta, and Hanoi

The report named the U.S. as the most threatened nation outside of Asia, with roughly 25 million people presently living on vulnerable land

Term Differentiation

"Global sea level" refers to the average height of all of the Earth's ocean basins

"Global sea level rise" refers to the increase in the average global sea level trend

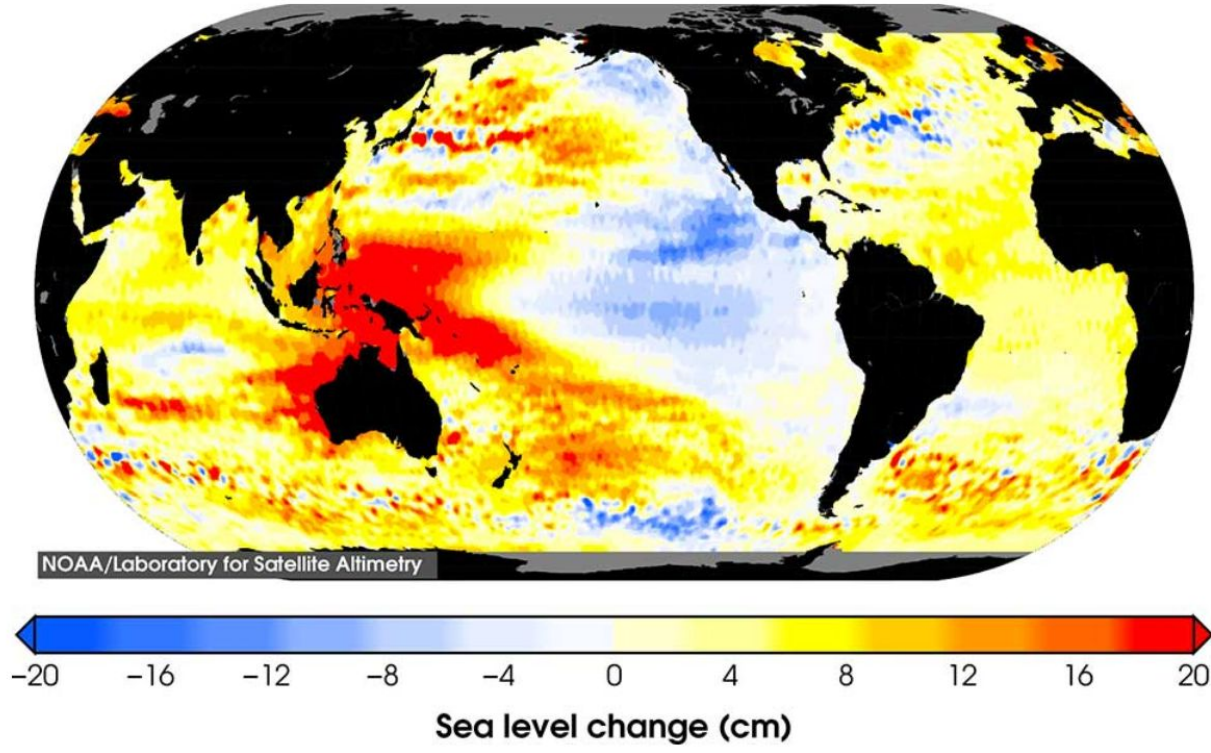
"Local sea level" refers to the height of the water measured along the coast relative to a specific point on land

"Relative sea level trends" reflect changes in local sea level over time

Relative Sea Level Trends

- The surface of the sea changes at different rates around the globe
 - For example, the absolute water level height is higher along the West Coast of the United States than the East Coast
- Relative change is the most critical for many coastal applications;
 - coastal mapping
 - marine boundary delineation
 - coastal zone management
 - coastal engineering
 - sustainable habitat restoration design
 - general public enjoying their favorite beach

The sea level **varies around the globe.**



Source: National Oceanic and Atmospheric Administration

Works Cited

How Stuff Works

Colorado Center for Astrodynamics Research at UC Boulder

U.S.'s Proceedings of the National Academy of Sciences.

Climate Central

National Oceanic and Atmospheric Administration

Thank You for Listening

Questions?