

Explainer: How do you measure a sea's level, anyway?

By Gary Griggs, The Conversation, adapted by Newsela staff on 09.21.17

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People often come across a sign like this one, indicating sea level. But which sea's level? And how is it measured? Photo from public domain

There are about 330 million cubic miles of water in the world oceans today. Early in our planet's 4.5-billion-year history, water slowly collected in the low areas of the planet's surface. These areas became ocean basins. As more water gathered there, the water level got higher and higher.

This height is called the sea level. It is related to the total amount of water in the oceans. Like a bathtub, the more water is in the oceans, the higher the sea level.

The sea level is also linked to the shorelines. As water levels rise, areas that used to be land get covered in water. As a result, the shorelines shrink inward.

Throughout history, the climate, the average weather conditions on Earth, has constantly changed. The sea level has gone up and down in response. As oceans warmed during one period of the planet's history, water expanded and the sea level rose. This is called thermal expansion. As the Earth continued warming, ice sheets and glaciers melted, adding more water to the oceans, which caused sea level to rise further.

Tide Gauges Are Like Large Pipes In The Ocean

People have been keeping track of the sea level for about 200 years. Until recently, this was done with devices called tide gauges. Tide gauges are anchored to structures along the coastline, such as docks. They record changes in the water level.

The oldest tide gauge in the world is on the coast of Poland. It was installed in 1808. In the United States, there are two tide gauges that have been measuring the sea level since 1856. One is in New York, and the other is in San Francisco. There are newer tide gauges as well, many of which were set up in the past 50 to 75 years.

A tide gauge looks like a large pipe inserted into the ocean. It has a float inside that moves up and down as the water level changes. As the tide rises and falls each day, these gauges record those changes in water level.

These instruments were not set up for the sake of scientific research. They were used to measure the depth of the water so that ships could enter and leave ports safely. As time went on, however, people noticed that the gauges were measuring long-term changes.

Coastal Areas Are Sinking And Rising

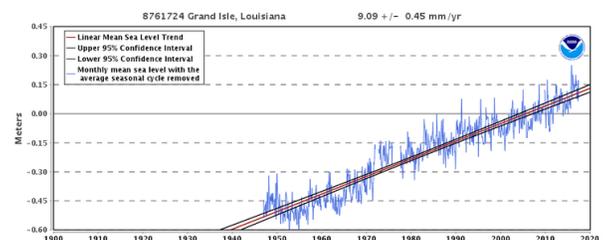
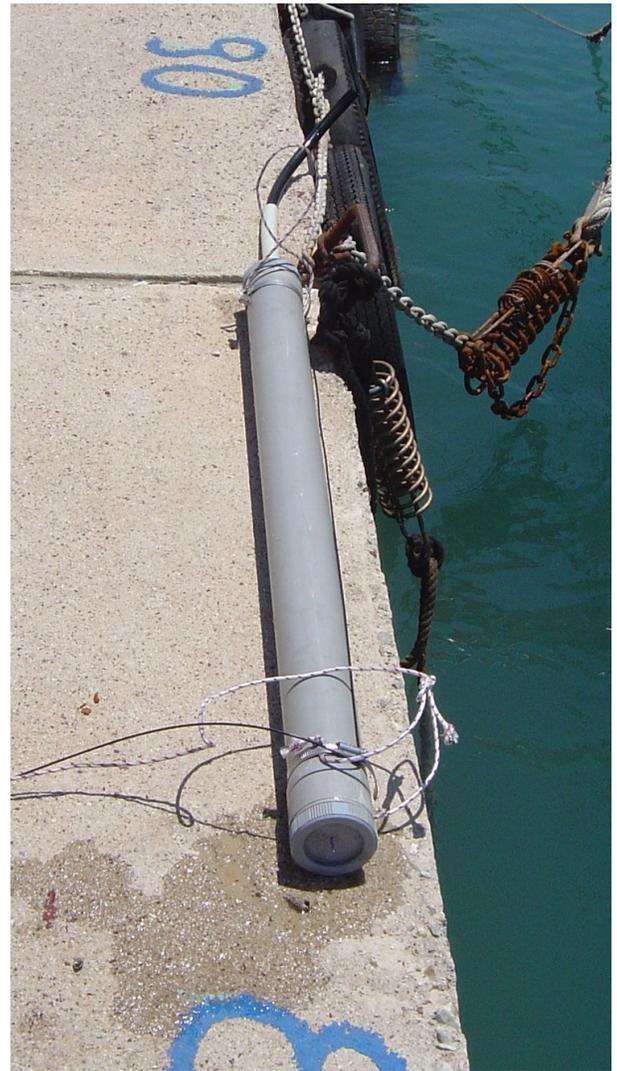
Each of these official tide gauges keeps track of sea level at a particular coastal location. Many coastal areas are not stable, however. Some are sinking, such as New Orleans or Venice. Others, like Alaska and Scandinavia, are rising. Each tide gauge keeps track of how the sea level is changing compared to the land on which it is anchored.

Some gauges are on coasts that are rising and some are on coasts that are sinking. That means that sea level changes are different from place to place. In parts of Alaska, the land is rising faster than sea level. As a result, the tide gauge actually records a drop in sea level compared to the land.

Overall, the sea level has risen nearly seven inches in the past 100 years.

In 1993, two satellites were launched into space. They were put into orbit around the Earth. Like our moon, they fly in circles around the planet.

Creating A Standard Sea Level



The satellites use radar technology to measure the level of the ocean from space. Unlike tide gauges, the satellites do not move up and down. This means they can provide standard measurements of sea-level changes.

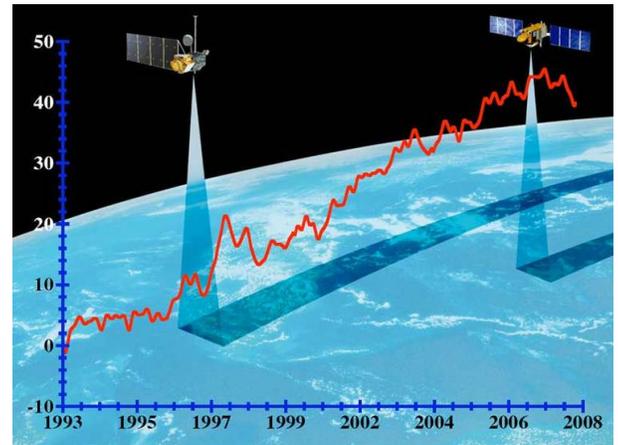
The satellites have measured a global sea-level rise of 3.2 millimeters per year since 1993. That rate is about 12 inches per 100 years.

Maps of both land and sea use the sea level as a base. Land elevations and ocean depths are measured against the sea level. However, the sea level is slightly different in different places around the world. This is due to differences in water temperatures, currents, atmospheric pressure and wind. These local differences make describing the sea level more complicated.

In order to simplify things, a standard sea level was established. It was based on sea level averages around the world. This standard was called the North American Vertical Datum (or NAVD). It is now the sea level used by all maps.

So what does it mean when a dock, highway or building is listed as "20 feet above sea level"? Now you know. It means "20 feet above this official North American Vertical Datum."

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Quiz

1 Read the paragraph from the introduction [paragraphs 1-4].

Throughout history, the climate, the average weather conditions on Earth, has constantly changed. The sea level has gone up and down in response. As oceans warmed during one period of the planet's history, water expanded and the sea level rose. This is called thermal expansion. As the Earth continued warming, ice sheets and glaciers melted, adding more water to the oceans, which caused sea level to rise further.

Which word from the paragraph helps the reader understand the meaning of "thermal"?

- (A) changed
- (B) warmed
- (C) expanded
- (D) continued

2 Read the selection from the section "Tide Gauges Are Like Large Pipes In The Ocean."

These instruments were not set up for the sake of scientific research. They were used to measure the depth of the water so that ships could enter and leave ports safely.

Which of the following words, if it replaced "sake" in the first sentence of the selection above, would CHANGE the meaning of the selection?

- (A) purpose
- (B) goal
- (C) intention
- (D) correction

3 Use the graph in the section "Coastal Areas Are Sinking And Rising" and the information in that section to select the TRUE statement.

- (A) Tide gauges show that sea levels near New Orleans are rising overall.
- (B) Tide gauges show that sea levels are rising faster than land in Alaska.
- (C) Tide gauges show that land in Alaska and Scandinavia is sinking rapidly.
- (D) Tide gauges show that land near New Orleans and Venice is rising rapidly.

4 Read the section "Creating A Standard Sea Level" and examine the image in that section.

Which sentence from the section is BEST illustrated by the image?

- (A) The satellites have measured a global sea-level rise of 3.2 millimeters per year since 1993.
- (B) However, the sea level is slightly different in different places around the world.
- (C) This is due to differences in water temperatures, currents, atmospheric pressure and wind.
- (D) These local differences make describing the sea level more complicated.