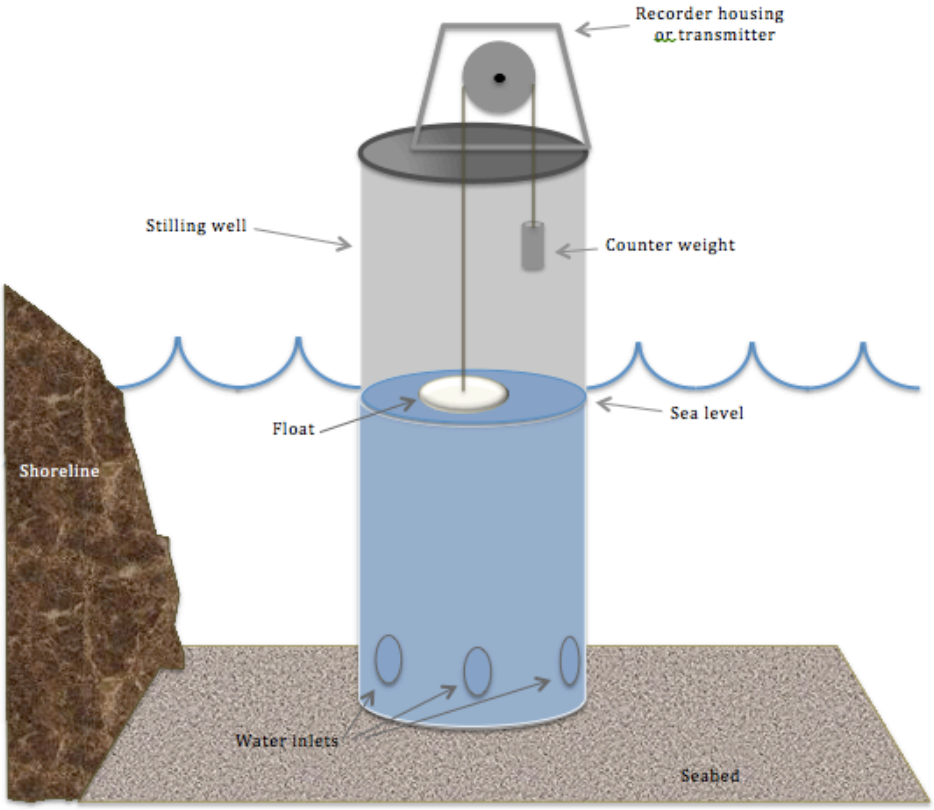
What are these gizmos and what are they for?

1. Make some guesses or share what you know here.

Here's a diagram of the inside of one of these contraptions.



2. It's called a stilling well. Now what do you think they do and how do you think this contraption works?

Besides being called stilling wells they are also called tide gauges. They've been used since the early 1800s to measure sea level heights. Now the data from these devices is read globally and through regularly received radio transmissions. Records have been kept since the early 1800's about the changing height of global seas.

The methods of measuring sea level have both changed and stayed the same.

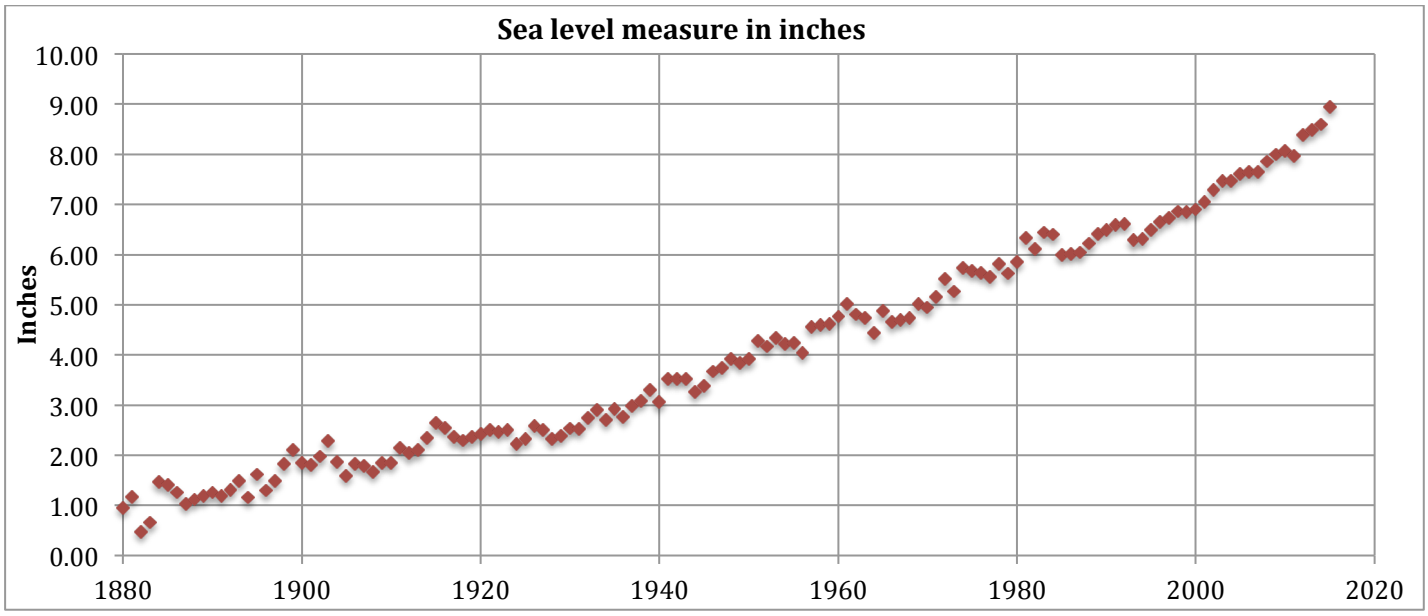
- Tide gauges (stilling wells) like the ones pictured on the previous page have always been used.
- Now satellites are used to analyze the topography of the ocean surface and calculate its changing depth. (Since 1992)

Measuring sea level is complex for lots of reasons.

Warm seawater has greater volume then cold seawater.
At different times of the year sea levels vary.
There is vertical land motion on our Earth and sea level is often measured according to land sightings.
Some years have greater glacial ice melt than other years.
Tides and the phases of the moon make sea level vary daily.

3. So if you wanted to measure changes in sea level, how might you account for all of those variations?

Here's a graph of the data that we found. The average sea level in these charts is related to the measurements in 1880. At that time sea level was deemed at the height of 0 inches and the chart below shows all of the sea level readings from 1880 to 2016.

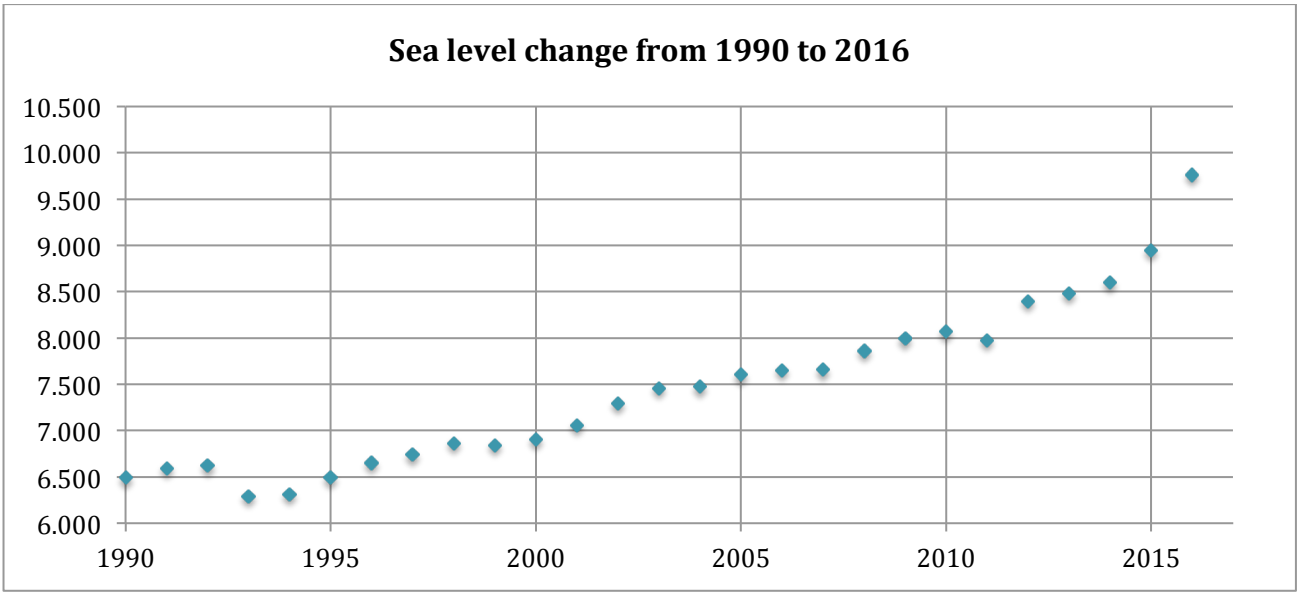


4. What do you notice in general about the sea level shown in this chart?

5. Does the change in sea level seem to be pretty constant in all of those years?

We wanted to be able to examine the data more closely. Instead of graphing all of those years from 1880 until now, we decide to graph a smaller segment of the data.

On the next page is our chart for the sea level change from 1990 to 2016. We noticed that there are some irregularities in this section of the graph.



6. Where do you see two surprising dips in the graph?

7. Can you guess some reasons that might have caused these irregularities?

Actually in 1992, a joint mission between NASA and CNES (the French Space Agency) launched the TOPEX/Poseidon satellite that measured 95% of the Earth's ice-free ocean to an incredibly accurate degree. These satellite readings gave scientists the ability to truly map the topography of the oceans. Perhaps that 1993 dip is related to the start of more accurate mapping of our Earth's water surface.

For 18 months in 2010 and 2011, Australia experienced severe rain and flooding. This is believed to have been caused by two cyclic events, partly related to La Niña that coincided over Australia. The Australian continent is unusual in that coastal mountains surround its interior. Rainfall in the interior does not flow towards the oceans. In 2010-2011, sea levels actually fell 7 mm. This fall in sea level is believed to partly be the result of so much water and flooding in the interior of Australia.

8. Calculate the rate of change of sea level for the entire period shown in the graph at the top of this page.

9. Calculate the rate of change in the graph above from just 2012 to 2016.

10. Create a line of best fit on the graph above and figure out its equation.

11. Do you think that the rate of sea level change will remain the same in the future?

12. Create an equation that might help you predict the sea level height in the future if the sea level rise rate remains about the same as your calculated 2012 to 2016 rate.

13. Using your equation, how far above the 1880 sea level markings do you expect sea level to be in 2050?

6. At this rate, what types of places (countries or cities or other descriptors) will be most affected by sea level rise by the year 2050?

Source: http://oceanservice.noaa.gov/facts/sealevel.html
http://climate.nasa.gov/vital-signs/sea-level/
https://www.epa.gov/climate-indicators/climate-change-indicators-sea-level
https://climate.nasa.gov/vital-signs/sea-level/
https://en.wikipedia.org/wiki/TOPEX/Poseidon
http://www.sciencemag.org/news/2013/08/scienceshot-why-did-sea-level-drop-2010