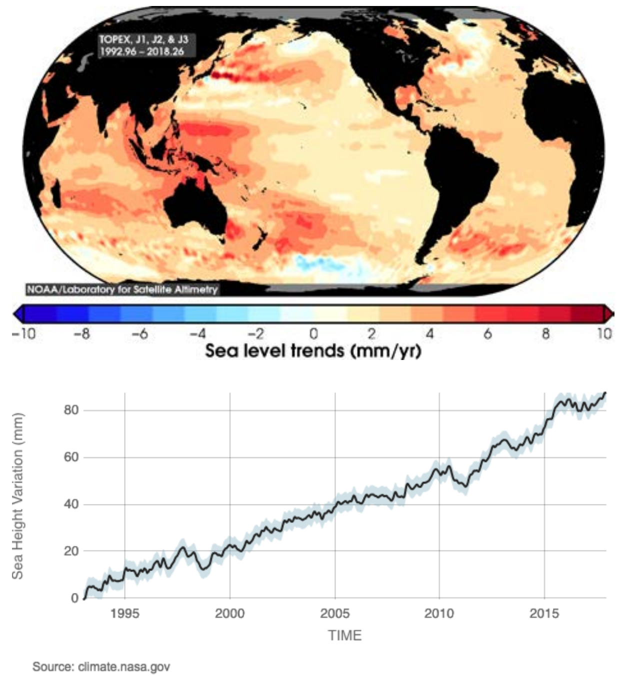
Module 4: Accelerating Sea Level Rise

Global sea level is affected by the heating of the oceans, the melting of ice on Greenland and Antarctica, the rising and falling of continents, and ocean currents. Since 1993, sea level has been estimated by orbiting satellite radar observations. The figure to the right shows that rate of sea level rise is not uniform throughout the world's oceans, but on average is rising. There is a lot of interest in these rising sea levels. Low lying areas may flood more often, cause higher storm surges, damaging buildings or contaminating ground water supplies. Low lying coastal communities need to plan for the costs of future infrastructure to deal with rising seas. Therefore, future projections of sea level have garnered a lot of interest.

One of the challenges in predicting future sea level in the is deciding whether or not the rate of sea level rise is constant or accelerating. This was raised in an article published a few years ago in [Newsweek]() which reported that sea level rise may be accelerating as the ice on Greenland and Antarctica melt. This means that sea level in 2100 may be double the currently expected rise. Is there a way for us to check to see if the rate sea level rise is steady or accelerating?



Satellite Sea Level Trends: Sea level trend is the average rate that sea level is rising or falling in millimeters per year. The top figure shows how this rate is different across the oceans. The lower figure shows the average rate of all oceans from 1993-2018. Images provided by NOAA NESDIS and NASA.

Information Sources and Data

- Morrissey et al. *Intro to the Biology of Marine Life* (Ch. 2, Ch. 14.0 and 14.1)
- Pereria, S. "Sea levels are surging at faster and faster rates as Antarctica and Greenland melt, Satellite data reveals." *Newsweek*, February 2, 2018.
- NOAA/NSIDC; Sea Ice Concentration and Sea Ice Index
  - GSFC. 2017. Global Mean Sea Level Trend from Integrated Multi-Mission Ocean Altimeters TOPEX/Poseidon, Jason-1, OSTM/Jason-2 Version 4.2 Ver. 4.2 PO.DAAC, CA, USA. Dataset accessed [2018-05-04] at http://dx.doi.org/10.5067/GMSLM-TJ42.
  - Wiese, D. N., D.-N. Yuan, C. Boening, F. W. Landerer, and M. M. Watkins (2016) JPL GRACE Mascon Ocean, Ice, and Hydrology Equivalent Water Height RL05M.1 CRI Filtered Version 2., Ver. 2., PO.DAAC, CA, USA. Dataset accessed [2018-05-04] at http://dx.doi.org/10.5067/TEMSC-2LCR5.
  - Wiese, D. N., D.-N. Yuan, C. Boening, F. W. Landerer, and M. M. Watkins (2016) JPL GRACE Mascon Ocean, Ice, and Hydrology Equivalent

Water Height RL05M.1 CRI Filtered Version 2., Ver. 2., PO.DAAC, CA, USA. Dataset accessed [2018-05-04] at http://dx.doi.org/10.5067/TEMSC-2LCR5.
    - Satellite altimetry and tide gauge sea level rise http://ccar.colorado.edu/altimetry/
    - Delaware Geological Survey future sea level rise projections https://www.dgs.udel.edu/projects/determination-future-sea-level-rise-planning-scenarios-delaware
    - Delaware Department of Natural Resources and Environmental Control (DNREC) sea level rise maps. http://www.dnrec.delaware.gov/Pages/SLRMaps.aspx

- Pair-Programming Video – Sea Level Records part 1 (https://youtu.be/VlO5dBNO-Uc)
- Pair-Programming Video – Sea Level Records part 2 (https://youtu.be/uaFFsyriqNY)

Questions to consider

1. Do you think that Pereria's claim is supported by the data?

2. Does the claim need to change given the additional data available since the article was published?

3. Are the trends in ice mass loss (rates) constant for the Arctic and Antarctic? Is one greater than the other?

4. Does the article make a causal or correlational link between ice mass loss and sea level rise?
5. How does satellite sea level rise compare to ground level measurements?

6. How do these rates compare to estimated sea level rise rates in Delaware?

7. If you were in charge of a Delaware coastal community, would this study change your planning outlook?