



## EXCERPT FROM...

## Climate Change: Global Sea Level

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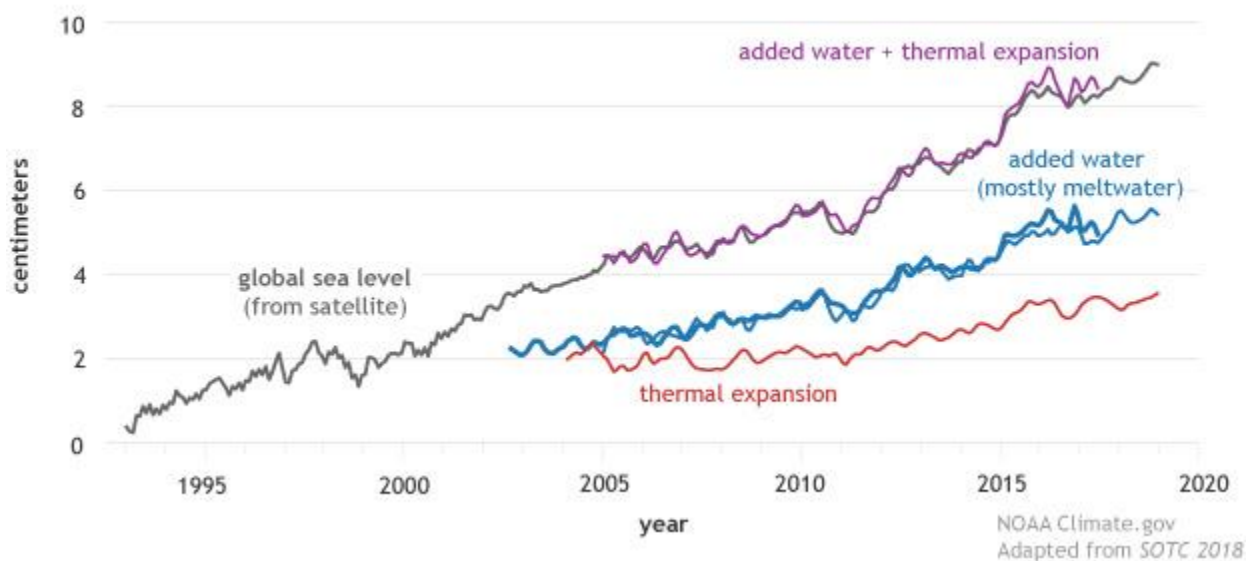
### MEASURING SEA LEVEL

Sea level is measured by two main methods: tide gauges and satellite altimeters. Tide gauge stations from around the world have measured the daily high and low tides for more than a century, using a variety of manual and automatic sensors. Using data from scores of stations around the world, scientists can calculate a global average and adjust it for seasonal differences.

Since the early 1990s, sea level has been measured from space using radar altimeters, which determine the height of the sea surface by measuring the return speed and intensity of a radar pulse directed at the ocean. The higher the sea level, the faster and stronger the return signal is.

To estimate how much of the observed sea level rise is due to thermal expansion, scientists measure sea surface temperature using moored and drifting buoys, satellites, and water samples collected by ships. Temperatures in the upper half of the ocean are measured by a global fleet of aquatic robots. Deeper temperatures are measured by instruments lowered from oceanographic research ships.

Contributors to global sea level rise (1993-2018)



Observed sea level since the start of the satellite altimeter record in 1993 (black line), plus independent estimates of the different contributions to sea level rise: thermal expansion (red) and added water, mostly due to glacier melt (blue). Added together (purple line), these separate estimates match the observed sea level very well. NOAA Climate.gov graphic, adapted from Figure 3.15a in *State of the Climate in 2018*.

To estimate how much of the increase in sea level is due to actual mass transfer—the movement of water from land to ocean—scientists rely on a combination of direct measurements of melt rate and glacier elevation made during field surveys, and satellite-based measurements of tiny shifts in Earth’s gravity field. When water shifts from land to ocean, the increase in mass increases the strength of gravity over oceans by a small amount. From these gravity shifts, scientists estimate the amount of added water.

**Read the entire article at:**

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>