

# NASA satellites confirm sea levels are on the rise

**David Perlman, San Francisco Chronicle, 8-27-15**

It's now clear that sea levels are rising around the world.

An international fleet of satellites is showing that they have already risen an average of nearly 3 inches since 1992, with some ocean areas showing a rise as great as 9 inches, and an unavoidable sea level rise of at least several feet is coming, say NASA scientists who are analyzing the satellite measurements.

"Given what we know now about how the ocean expands as it warms, and how ice sheets and glaciers are adding more water to the seas, it's pretty certain we are locked into at least 3 feet of sea level rise, and probably more," said R. Steven Nerem, a University of Colorado Arctic specialist, during a televised briefing Wednesday.

"But we don't know whether it will happen within a century or somewhat longer."

Three sets of ongoing space satellites have been reporting measurements continually for the past 23 years and are committed to keeping track in the future, said Nerem, NASA's leader of a new interdisciplinary team of sea level specialists.

The NASA scientists said the rate of sea level increases varies across the world's ocean basins. Those differences are caused by many influences, including the effects of ocean currents and natural cycles like the "Pacific Decadal Oscillation" that brings El Niño to California.

"Sea level along the West Coast has actually fallen over the past 20 years because long-term natural cycles are hiding the impact of global warming," said Joshua Willis, an oceanographer at NASA's Jet Propulsion Laboratory in Pasadena. "However, there are signs this pattern is changing and we can expect accelerated rates of sea level rise along this coast over the next decade."

The NASA scientists estimate that about one-third of the observed sea level rise is caused by the expansion of water in all the oceans as they heat up due to global warming. Another third is the result of billions of tons of ice dumped into the oceans from the massive Greenland and Antarctic ice sheets. The remaining third results from melting mountain glaciers, the scientists conclude.

Their satellite measurements show that the Greenland ice sheet — almost as big as Alaska — sheds an average of 303 billion tons of ice each year, and the Antarctic ice sheet — larger than the United States and India combined — has lost an average of 118 billion tons of ice a year into the sea.

"We've seen from the paleoclimate record that sea level rise of as much as 10 feet in a century or two is possible if the ice sheets fall apart rapidly," said Thomas P. Wagner, NASA's program chief for climate change and the oceans. "We're seeing evidence that the ice sheets are waking up, but we need to understand them better before we can say we're in a new era of rapid ice loss."

The first satellite to measure sea level rise was named Topex-Poseidon, a joint mission of NASA and CNES, the French space agency. It carried two radar altimeters and flew in orbit from 1992 until 2005. Then came Jason-1, another U.S.-French mission launched that same year and still flying. A third satellite, Jason-2, is also measuring sea level rise with more sophisticated instruments, and another version called Jason-3 is coming next year.