

## After a Three-decade Hiatus, Sea-level Rise May Return to the West Coast

*Sea level in eastern Pacific may begin to rise due to climate regime shift, say Scripps Oceanography researchers*

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The West Coast of North America has caught a break that has left sea level in the eastern North Pacific Ocean steady during the last few decades, but there is evidence that a change in wind patterns may be occurring that could cause coastal sea-level rise to accelerate beginning this decade.

That is the conclusion of researchers at Scripps Institution of Oceanography, UC San Diego, who said that conditions dominated by cold surface waters along the West Coast could soon flip to an opposite state.

"There are indications that this is what might be happening right now," said Peter Bromirski, lead author of a study now in press in the *Journal of Geophysical Research-Oceans*, published by the American Geophysical Union.

Global sea level rose during the 20th Century at a rate of about two millimeters (.08 inches) per year. That rate increased by 50% during the 1990s to a global rate of three millimeters (.12 inches) per year, an uptick frequently linked to global warming. Rising sea level has consequences for coastal development, beach erosion and wetlands inundation. Higher sea levels could cause increased damage to coastal communities and beaches, especially during coincident high tides, storm surges and extreme wave conditions.

Several state and federal agencies, led by the California Department of Boating and Waterways, funded the study. Support also came from NOAA, the National Science Foundation, and the California Energy Commission.

Scientists date the current phase of a Pacific Ocean climate cycle called the Pacific Decadal Oscillation (PDO) to the mid- to late-1970s. The current "warm" phase is characterized by the upward movement, or upwelling, of cold water toward the surface along the West Coast. Despite a few El Niño-induced surges in sea level during that time, the coastal sea level trend has mostly been steady.

When the cycle shifts to its negative "cold" phase, coastal ocean waters will become characterized more by a downwelling regime, where the amount of colder, denser water currently brought to the surface will be reduced. Resulting warmer surface water will raise sea level.

Bromirski and fellow Scripps oceanographers Art Miller, Reinhard Flick and Guillermo Auad (now at the U.S. Department of the Interior's Bureau of Ocean Energy Management, Regulation & Enforcement) studied the wind stress patterns that characterize the different phases of the PDO. Wind stresses can act to change the characteristics of the coastal upwelling/downwelling regime, i.e. suppress or raise sea level.

The authors write that the characteristics of wind stress variability over the eastern North Pacific "recently reached levels not observed since before the mid-1970s regime shift. This change in wind stress patterns may be foreshadowing a PDO regime shift, causing an associated persistent change ...that will result in a concomitant resumption of sea level rise along the U.S. West Coast to global or even higher rates."

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