

**Effects of the 2015-2016 El Nino in Southern California estuaries and implications for elevated sea levels**

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**Abstract**

During the 2015-2016 El Niño, Southern California experienced anomalously high offshore temperatures, sea levels, and wave heights. As these conditions are predicted to be more common with climate change, the El Niño provided a window into how estuaries along the Southern California Bight might respond to a future climate. The low rainfall totals during the 2015-2016 El Niño provide the opportunity to examine how extreme ocean forcings impact estuaries independently of fluvial events. From October 2015 to May 2016 water levels, salinity, and temperature were continuously measured in 10 estuaries in Southern California. The observed systems included both intermittently open and perennially open estuaries with varying watershed size, degrees of development, and management practices. During the El Niño, elevated water levels offshore, due to the combined effects of surge, tides, wave setup, and higher sea levels, caused elevated water levels and prolonged inundation in all the estuaries. In the perennially open systems, the water levels in the estuaries closely followed the water levels offshore. In the intermittently open systems, the water levels in the lagoons were a function of both water levels offshore and the heights of the sand sills in the inlets. Several of the intermittently open systems closed when sand (driven into the inlet by wave-induced sediment transport) accreted and formed barrier bars at the mouths. The closures caused prolonged elevated water levels, increased stratification, and hypoxia. One of the systems had not closed since the 1983 El Niño, indicating that with higher sea levels and larger waves it is possible these systems will close more frequently. Understanding how coastal lagoons respond to increased sea levels will help managers, scientists, and agencies develop and implement adaptation strategies.