

Science Sunday
Sunday, May 17, 2020, 1:30 - 2:30 PM PDT

**“Sea Level Rise, Extreme Water Levels, and Coastal Erosion: How
Bad Can It Be?”**

During the Science Sunday presentation on Sunday, May 17, 2020, we recorded all the questions we were unable to answer during the 10-minute moderated Q&A.

1. Why is sea level rise different on the East vs West Coast?

“Absolute” sea-level rise is similar on the East Coast and on the West Coast. However, the main difference between the East and West Coasts are the rates of “relative” sea-level rise. The West Coast is a tectonically active coastal margin, and much of the West Coast is uplifting ever so slightly. The East Coast on the other hand is a passive coastal margin with relatively little tectonic activity. Much of the East Coast (particularly the south Atlantic states and the Gulf) is actually subsiding (sinking) and therefore the apparent or so-called “relative” sea-level rise is much higher. Here is an example of a high rate of relative sea-level rise near New Orleans that is closely caused by land subsidence:

https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8761724

2. Based on your work, do you see coastal communities planning for long or short-term sea level rise?

I believe it is best to start planning for long-term sea-level rise scenarios since the long-term scenarios of 0.5 m of sea-level rise or more will ultimately determine the sustainability of coastal communities. In the short term, I believe planning is needed to improve resiliency, i.e., the ability to recover from episodic coastal hazards like large wave events that can cause temporary severe coastal erosion or coastal flooding (more so than short-term sea-level rise)

- 3. I attended a seminar at Scripps in the 1980s where the presenter showed historical photos and storm records showing much more intense winter storms in SoCal in the late 1800s resulting in much more cliff erosion with 45 degree angles of repose rather than near vertical cliff. It was suggested that there is a long period cycle of storm intensities in the region and it was predicted to ramp up. Did this hold up, and if so what effects on sediment production would be expected?**

Interesting! The biggest factors contributing to cliff erosion in California are waves and rainfall. The climate cycle that recently has had the most impact on wave heights in California is certainly El Nino. The 1982-1983, 1997-1998, and 2015-2016 El Nino events caused large waves and consequently large amounts of erosion. We don't have good records of wave heights (or rainfall) dating back to the 1800's, but I would guess that those factors would be most responsible for historical erosion.

Following the periods of cliff erosion, it is likely that the beaches responded by accreting (or building out) after all of the eroded cliff material was broken down into sand. For soft cliffs (with lots of sandy material) this process of building beaches out can be quite rapid. On the other hand, it can take much longer for rocky cliffs, and the beach genesis is less likely.

- 4. In an Oceanography class I took at Cabrillo about 30 years ago, I was told that Jack O'Neill's house is in danger of coastal erosion. Has anything been done along that coastline to save that house/neighborhood? What is your take?**

Many houses (including the Jack O'Neill house) along East Cliff Drive and Opal Cliff Drive have been threatened by cliff erosion. Many of these houses have put up vertical seawalls or rip rap to prevent additional erosion. In some cases, the seawalls and rip rap has prevented additional land loss. However, it is likely that the beaches fronting these cliffs have received less sand by preventing the cliffs from eroding.

5. How concerned are you with erosion control quick fixes such as rip-rap?

(Note: Rip-rap, shot rock, rock armor, or rubble, is man-placed rock or other material used to armor shorelines, streambeds, bridge abutments, pilings and other shoreline structures against scour and water, wave, or ice erosion.)

Almost the entire stretch of West Cliff Drive from Its Beach to Natural Bridges has rip rap filled in throughout eroding pockets. In general, I think it is preferable to avoid dumping rip rap as a quick fix to erosion, since rip rap often reduces beach access and sandy beach extents. However, there are some exceptions to this “rule”. West Cliff Drive has several “sea caves”, and these caves can develop and erode back very quickly (e.g., over the course of a single winter surf season). These caves can quickly undermine the highway and cause sinkholes, and thus I think filling sea-caves with rip rap as an erosion control quick fix is not unreasonable in certain cases.