Our Ocean Backyard—*Santa Cruz Sentinel* columns by Gary Griggs, Distinguished Professor of Earth Sciences, UC Santa Cruz

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**Rising Water Threatens Coastal Cities**

Our ocean backyard is slowly moving toward us as sea levels continue to rise and the ocean gradually creeps farther inland during the highest tides. The King tides of mid-November were a little disappointing for anyone expecting to see something akin to a tsunami rolling in. King tides are no different than our normal twice daily high tides, except they are the highest and lowest we see several times each year; but they are still only a few tenths of a foot above the other high tides. In Santa Cruz these highest yearly tides are generally in the range of 6.6 or 6.7 feet.

Along very low-lying shorelines, like Capitola, Rio del Mar, and those portions of East Cliff Drive that are nearly at beach level (Twin Lakes, Corcoran Lagoon, and Moran Lake, for example), you might notice the water coming in a bit farther during these very high tides. During the mid-November King tides, however, due to a combination of wide sandy beaches and very small waves, the water level differences weren’t really very apparent.

What has been more noticeable and has had much greater impacts in the recent past has been the combination of a large El Niño, which may elevate sea level a foot or more, and the simultaneous arrival of large waves at times of high tides. These conditions were responsible for the major damage along the Santa Cruz coast in the first three months of 1983.

Over the next 30 or so years, probably until about mid-century, it will be these short-term events, like the El Niño winter of 1983, that will have the greatest impacts on the state’s coastal development and infrastructure. Beyond mid-century, and likely for centuries after that, it will be the gradual rise in global sea level that will be the most challenging condition that cities, states and nations have ever had to deal with. To be clear though, the short term events will be elevated by progressively higher sea levels.

Over the past ten years, the global rate of sea-level rise has been about 4.5 mm/yr. or approximately 18 inches/century. This rate is accelerating, however, as ocean temperatures rise and the seawater expands, and as the land ice continues to melt at more rapid rates. And there is a lot of ice spread out over Greenland and Antarctica as well as the remaining mountain glaciers of the Himalayas, the Alps and Andes, for example. If all of this frozen water were to melt, sea levels would rise globally about 216 feet. You can check any topographic map or website to find out what elevation your home is at, but odds are high in Santa Cruz that you are below 216 feet. If you live in the Westlake area or Bonny Doon, you are safe from future sea-level rise.
To be clear, no competent scientist believes all of that ice will melt in this century or the next. All of it doesn’t have to melt to create major problems, however. At very high tides today, waters of San Francisco Bay are slopping over onto the Embarcadero. The major problems at present, however, are in all of the Atlantic coast cities that were built almost at sea level. These include cities like New Haven, Boston, Washington DC, Wilmington, Baltimore, Philadelphia, Charleston, Norfolk, Savannah and Jacksonville. At least 10% of each of these cities is now subject to tidal flooding, and by 2030, they will experience these events at least two dozen times every year. By 2045, just 25 years from now, most of those cities will experience over 100 days of salt water flooding annually, that’s one out of every three days. Not only will the frequency of flooding increase, but so will the depth and inland extent as sea levels continue to rise.

The runways of the San Francisco International Airport will begin to flood at high tides with a foot of additional sea-level rise, and they will nearly all be under water with three feet of rise. This is not news to the airport management who have recently developed a plan to build a 10-mile long, eight-foot high, steel sheet-pile and concrete seawall to provide protection from rising water levels. SFO’s shoreline protection project, with an estimated cost of $587 million, has been approved by the San Francisco Board of Supervisors and is now entering the environmental permitting process. They hope to have a draft Environmental Impact Report completed in 2021, and if all proceeds as planned, they anticipate physical construction in the 2025-2035 timeframe. At this price the seawall will cost $11,117/linear foot.

I am often asked if I’m worried about the future. I am definitely worried about the future, but honestly, I’m more concerned about what is happening now.