

**Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.**

**#107 June 2, 2012**

**Are Waves Getting Bigger?**



*During the El Nino winter of 1983 large waves at high tide over topped the seawall along Beach Drive in Rio del Mar.*

Big waves are one of the things that many people associate with the central coast. Mavericks and Steamer Lane are known around the world for legendary waves that attract surfers and surfing contests year after year. Surfers may be happy to know that there is some evidence that waves are getting even larger. In recent decades increases in wave heights from the most intense storms have occurred in both the North Atlantic and the Northeast Pacific.

In the Atlantic this increase has been documented by the Seven Stones light-ship anchored on a reef offshore from the southwest coast of England. Similar increases have been detected in the Northeast Pacific in the records from a series of 24 NOAA buoys along the west coast.

Although the information from offshore wave buoys only extends back about 30 to 35 years, there are observable increases in wave heights that are taking place. While it is not yet completely certain if these increased wave heights are related to the warming of oceans, there is a high probability that these are in fact related.

The causes for increased wave heights are not agreed upon yet, but might include changes in storm tracks, higher wind speeds, more intense winter storms, or other factors. Whatever the cause, the increases are important in their impact on ship and boating safety, shoreline hazards including coastal erosion, and in the engineering design of ocean and coastal structures.

The Pacific Northwest is well known for the severity of its wave climate. The largest waves off the coast of Washington were measured at the Grays Harbor buoy on March 3, 1999. Offshore wave heights exceeded 29 feet for over five hours, and the highest waves recorded during that storm were nearly 35 feet.

Wave height increases along the west coast are greater off the northern California, Oregon and Washington coasts than offshore central and southern California. Over the past 35 years, the average wave height (designated as the significant wave height, or the average of the highest 1/3 of the waves) off Oregon has increased 1.7 feet. But, the average of the five highest waves recorded in this same area each year has increased by 8 feet during this same period. The average waves are getting larger but the biggest waves are getting larger faster.

Along the California coast, average wave heights during the 20-year period from 1980 to 2002, increased about 1.5 feet along the central California coast. Averages don't tell the whole story, however. If you have one foot in 140-degree scalding water and one foot in ice water, on average you are a reasonable 70 degrees, but you're far from comfortable.

Looking more carefully at changing wave heights along the southern California coast over the past 25 years, from 1984 to 1995 there were seven storms that produced wave heights of 16 feet or greater and four storms that generated waves 20 feet or higher. Over the next 15 year interval from 1996 to 2010, there were 69 events with waves of 16 feet or greater and 10 events that resulted in wave heights of 20 feet or greater.

Whether this trend of increasing wave heights will continue into the future isn't clear yet. The Monterey Bay coastline has experienced coastal storm damage at times of high tides, large storm waves, and elevated sea levels throughout at least the past 140 years of newspaper history. East Cliff, Capitola, Seacliff and Rio del Mar have all been repeatedly hammered.

When increasingly large waves are combined with a gradually rising sea level, we can expect more frequent flooding and inundation of low-lying areas and an increased rate of coastal cliff and bluff retreat. Although wave characteristics may change in the future in unknown ways, their patterns over the past several decades have been well documented. The effects of storm waves on the coast are not new to Monterey Bay or California, but these effects are likely to be gradually exacerbated by rising sea levels.