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

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Big Waves Surfing

Large wave at Mavericks, Photo by Shmuel Thaler, Santa Cruz Sentinel.

Guinness World Records confirmed a few weeks ago that Garrett McNamara had indeed ridden the largest wave ever surfed. In November of last year, the 44-year old Hawaiian surfer rode down the face of a 78-foot high wave off the coast of Nazare, Portugal. He said he originally didn't want to attempt any more waves that day after wiping out a number of times on even bigger waves in the same location. For risking his life, he was awarded $15,000 for the biggest wave ridden last year.

It took a while for the judges to officially agree on the height of the wave, which was accomplished by carefully looking at high-resolution digital images from different angles. They used McNamara's height in a crouch and the length of his shinbone and compared these to the top and bottom of the wave. Documenting the height of the largest wave every ridden has gotten pretty scientific. To claim the largest wave ever ridden, it's not enough to say, well I think it was about 75 feet high.

Huge waves fascinate many of us and surfing big waves has evolved into one of those extreme adventures for a handful of surfers. Mavericks has become legendary along the central coast for huge winter waves. Ghost Tree on the 17-Mile Drive and Nelscott Reef along the central Oregon coast are developing similar reputations for having very large waves under the right set of conditions.

Other than the occasional tsunami and the semi-daily tides, which are waves of a different sort, all the waves we see breaking along our coast, whether at Pleasure Point, Steamer Lane, or Mavericks, are generated by the wind. Wind blowing across the ocean transfers energy to the sea surface, initially forming small ripples, which over time, if the wind persists, will grow to form distinct waves. Ultimately, the size of the waves is a function of the amount of energy transmitted to the ocean surface, which in turn is determined by the velocity of the wind, the length of time the wind blows, and the distance over which the wind blows.

In order to get really big waves, we need to have high velocity wind (40 to 50 mph) persisting for an extended period of time (36-48 hours) over vast stretches of ocean (500 to 1000 miles). While you can get very small waves by blowing into your coffee cup, modest size waves in a pond or a lake, it takes an ocean, like the Pacific, to crank up really large waves.

We get a lot of large storms in the North Pacific, which send big waves towards the coast of California. But obviously, those waves are much larger at some places than others. The same storm south of the Aleutians will produce very different sized waves at Mavericks than at Cowells. Why?

The bottom topography is the other big factor affecting how high those waves can get as they approach the coast. As waves enter shallower water, their underwater portions begin to feel the drag of the seafloor and they start to slow down. The water beneath the waves is also being compressed into shallower and shallower water, so the waves will increase in height as they get closer to shore.

Where bedrock on the seafloor, a reef, or an otherwise shallow area of seafloor is encountered, the portion of the wave passing over the high area will slow down, and the rest of the wave front will refract or bend around the rock outcrop or reef. Waves will thus wrap around points or high areas on the seafloor, concentrating energy and producing higher waves at these locations. Many of California's legendary surfing spots are located at points where wave refraction concentrates wave energy so waves progressively break, forming a line up. Malibu, Rincon, Pleasure Point and Lighthouse Point, to name a few, are prime examples.

We don’t normally use the height of a crouched surfer, or the length of their shinbone, to accurately measure wave heights. Waves have been measured accurately with offshore buoys or seafloor pressure gauges for about 35 years along California’s coast. There are presently 25 active gauges or buoys, most of them offshore southern California. These instruments are maintained and their data recorded by the Coastal Data Information Project (CDIP) and by NOAA through their National Buoy Data Center (NBDC), which both have websites with a lot of information available on-line.

The closest wave-recording buoy to Monterey Bay is a NOAA buoy, about 27 miles offshore in nearly 7000 feet of water. It has wave records extending back to 1987. These buoys are paid for by your taxes, and the information is there for your use.

If you are curious, you can dig out all sorts of interesting wave data. In the last ten years (2001-2011), for example, there were 99 offshore events when waves exceeded 23 feet in height for at least 3 hours. There were 31 periods when waves were at least 26 feet high for 3 hours, and in 2008, on four occasions waves were over 29 feet high. This is not Garrett McNamara’s 78 foot wave, but we do get some very large waves offshore. For my next column: is the wave climate changing along the west coast and are waves getting larger?