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

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Disappearing Beaches

Seasonal changes along West Cliff at Mitchell's Cove, Santa Cruz. *Photos: Gary Griggs*

The shoreline and the mountains have taken a bit of a beating this winter as long overdue storms finally slammed into the central coast. The largest waves officially recorded offshore Monterey Bay since we began measuring them in 1978 hit the coast and finally broke the back of the nearly century old concrete ship.

Beaches have lost a lot of sand, and in some places, the shoreline is just bedrock and cobbles. While this looks bad at first glance, it's part of the typical summer-winter cycle of beach accretion and erosion, or advance and retreat.

Those wide sandy summer beaches look pretty stable and permanent but sand rarely sits still for long. Waves are constantly at work, pushing the sand back and forth across and along the beach face.

Along the west coast, and along any shoreline where there is a significant seasonal change in the wave climate, we can observe this process taking place annually. From late spring into early fall, the long wavelength, long period, gentler waves, often from southern hemisphere winter storms, push the sand onshore.

The berm, or the high flatter part of the beach where you lay your towel or play volleyball, is usually at its widest in September- think of Labor Day weekend at Main Beach. At places like Main Beach and Seabright, this berm may be several hundred feet wide.

But as the seasons begin to shift and the first early storms arrive, the steeper and more energetic winter waves stir up the sand and begin to carry it offshore, leaving behind a much narrower winter berm. In some winters, like this one, there may not be much berm left at all.

The total amount of sand on the exposed beach and offshore is about the same, but it's been redistributed in response to different seasonal wave conditions. The offshore sand usually takes the form of shallower bars separated by deeper troughs.

Because the water depth where waves break offshore is determined by the height of the waves, the presence of these sand bars causes the larger winter waves to break farther offshore. This dissipates more of the wave energy, which reduces the energy expended on the shoreline. You can think of these offshore winter bars as natural shock absorbers or shoreline buffers.

By the time the wave climate calms down in late spring, the less energetic waves begin to start moving the offshore sand back onto the berm again. By June the beach has widened, just in time for the arrival of summer tourists and beach goers.

The balance between a winter and a summer beach, or the particular wave conditions that either move sand offshore or onshore, is somewhat delicate and can change quite quickly. Years of beach observations as well as experiments in large wave tanks have shown that the wave steepness, or the ratio between the wave height and the wave length (the distance between any two wave crests), or height/length, exerts the strongest influence on whether sand moves onshore or offshore.

Winter waves tend to be steeper and are more effective at eroding sand off the beach and transporting it offshore. The less steep summer waves move sand the other way, back onshore to build the berm, providing us a place to sit. While the width of the summer beach is not exactly the same each year, and neither is the width of the winter beach, these patterns or shifts from winter to summer are normal and expected.

Some winters are just a lot more energetic than others, which means a lot more sand is carried offshore. But, it will return.