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‘The biggest challenge human civilization has had to face’: What California’s big winter storms mean for the future

Sea level rise is making storms, and our relationship with the shoreline, more complicated



Gary Griggs, Distinguished Professor of Earth Sciences at UC Santa Cruz, stands along West Cliff Drive in Santa Cruz, Calif., on Thursday, Jan. 25, 2023 near storm damage that collapsed part of the road. (Nhat V. Meyer/Bay Area News Group)

By **PAUL ROGERS** | progers@bayareanewsgroup.com | Bay Area News Group



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For three weeks after Christmas, California was pounded with a series of nine atmospheric river storms. The drenching rains replenished reservoirs that had been seriously depleted during three years of severe drought.

But they also caused flooding from the Central Valley to Santa Barbara, triggering mudslides, sinkholes and power outages, and left 22 people dead. Along the coast, big waves ripped a 40-foot hole in the Capitola Wharf, destroyed facilities at Seacliff Beach State Park, flooded homes, wrecked businesses and caused millions of dollars in erosion.

For the past 55 years, [Gary Griggs](#), a Distinguished Professor of Earth Sciences at UC Santa Cruz, has studied big storms, sea level rise and California's changing coastline. UCSC's longest-serving professor, he is one of the nation's experts in the ways oceans reshape the land.

This conversation has been condensed and edited for clarity and length.

Q: We've always had big storms. Is climate change making them worse?

A: I think that's fair to say. It's really difficult to attribute any one event to climate change. But the more we see in terms of the size of storms, and the intensity of hurricanes, droughts and temperatures, the more difficult it is to say this is totally independent of that.

We do know that as the ocean gets warmer it evaporates more water. And warm air can hold more moisture.

Q: How much has the sea level risen and how high is it likely to go as temperatures continue to increase?

A: Over the last century in California, the ocean has risen about 8 inches. We know sea level rise is accelerating: Over the last 10 years it has been rising at a rate of about 20 inches per century. We can project out to 2050 with some assurance and say it's going to be at least 1 foot, and maybe more. Getting out to 2100, estimates range from 3 feet to 10 feet. What's far more important are these extreme events like we had in early January. High tides and big waves at the same time lead to the greatest damage.

Q: What does that mean for future big atmospheric river storms?

A: We had really high winds and really big waves in these storms. If that's a trend for the future, we'll see incrementally more damage. Every extra 6 or 8 inches of sea level rise will bring the waves closer to the shoreline and wash up higher to extend the damage further inland.

We tend to think of atmospheric rivers as rainfall. But we had some really big winds, so the waves were going up over the bluffs. Those waves had their origin 2,000 or 3,000 miles away. When they got to the shore line, you could see the winds blowing them inland.

Q: What kinds of places and facilities around Northern California are most at risk from rising seas and the wetter atmospheric rivers that scientists expect?

A: There are two types of places — very low-lying areas like Stinson Beach, San Francisco Bay, Rio Del Mar or Capitola. They are literally on the sand. They are going to be influenced by higher sea levels and waves moving farther inland, and have more frequent flooding.

Second are bluffs and cliffs. The higher the sea level is, the closer those waves are breaking to the cliffs. I would expect cliff and bluff erosion rates to accelerate in the future.

Q: What can we do about it?

A: We've been making short-term decisions forever. We are putting Band-Aids on things.

At this point, we have to start thinking longer term. We have to start agreeing on some things. Sea level is rising. We can measure it. We know it's accelerating. So when do we decide we've got to do something?

We've moved apartments, we've moved houses back, we moved Highway 1 inland in Sonoma County at Gleason Beach and also down at San Simeon. At some point we are going to have to start moving more back. No property owner wants to talk about that. It's become a bit of a bone of contention.

In the long run, it's not just more armor. The Army Corps of Engineers loves to build stuff. They have proposed a wall around Charleston (South Carolina), a wall around Miami, a wall around Galveston (Texas), and parts of New York and New Jersey. What are we getting for that? Is this going to get us 5 more years or 10 more? At what point do we say we can't keep doing that?

Q: But there are hundreds of billions of dollars of property in these places.

A: At the San Francisco airport, SFO's seawall is projected to last until 2085. That's a place you want to save as long as you can. But how high can you build a wall? I would say let's not build any more really expensive facilities — power plants, sewage plants or desalination plants where we know they are going to be inundated in 30 or 40 years. We need to look further ahead.

What do we do? I think this is the biggest challenge human civilization has had to face. Human civilization really began when sea level leveled off about 8,000 years ago. It's been pretty constant until the last century. So people haven't had to deal with it. But this is going to go on for centuries. I don't know. Maybe we concrete in the first floor of condos in Miami and move the utilities up. But when you look at the Embarcadero in San Francisco and see all those big bank buildings, and the water splashing on the road at high tide, you say 'wow!'

Q: What about the politics? I don't see how anyone can get re-elected if they tell people "all of your coastal property is worthless."

A: I think you are right. But we are just beginning to deal with the insurance issues. FEMA and insurance companies have been dealing with repeated payouts. Some private insurance companies are now refusing to insure these places. If you can't get insurance you can't get a mortgage. Economics may begin to play a role.

Q: How do you think all of this is going to play out in San Francisco Bay?

A: Places like the airports and Highway 37 in the North Bay will be protected with short-term approaches for a while. But at some point it's not going to be economically feasible to keep building walls.

We have Sausalito. But how many floating cities can you build? This is way beyond the scope of anything we've ever had to deal with before. We are going to protect some facilities. But can you put a sewage treatment plant on stilts? In the end we are going to have to retreat in a lot of these places.

Q: Bottom line, it sounds like eventually we're going to have to give up some land and move back?

A: Yes. Thousands of years ago, sea level was 20 or 30 feet higher than today. So what we call sea level today is just a point in time.

Gary Griggs

Age: 79

Position: Distinguished Professor of Earth Sciences, UC Santa Cruz

Hometown: Altadena, Calif.

Residence: Santa Cruz

Education: B.A., Geological Sciences, UC Santa Barbara (1965); Ph.D., Oceanography, Oregon State University (1968)

Five facts about Gary Griggs

- He is the longest-serving professor in UC Santa Cruz history
- He has written 14 books
- He is a former surfer and paddleboarder
- He has taught 16,000 students in his career
- He's been to Patagonia, India, Tibet, Nepal, China, Turkey; sailed around the world twice, and been to Vietnam, Ghana, Morocco and other countries.

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